electrical contracting

ENGINEERING • INSTALLATION • MAINTENANCE

Industrial Electrification SECTION
PAGES 51-62

SEPTEMBER • 1940

See How Easy It Is to Install This G-E TIME SWITCH

Side hinges keep cover out of way while you wire switch. Leaves both hands free for fast work
Five standard knockouts in back, bottom, and sides make it easy to attach leads from any direction
Even though switch is small enough to hold in one hand, there's plenty of room for fast, two-handed work around terminal block

IT'S just a matter of minutes—installing this modern, general-purpose time switch. Everything has been done to make the wiring job as easy, simple, and fast as possible—because that means less installation cost, and more profit for you.

Telechron Motor and Sturdy Construction Save Call-backs

Once you have installed a Type T-44 time switch you won't have to worry about service call-backs eating up your profits. The well-known Telechron motor and sturdy, simple construction mean long, dependable service and accurate timing.

The switch is housed in an attractive, drawn-steel, electrogalvanized and lacquered case suitable for either indoor or outdoor installation.

Get This Easy, Extra Profit

The season for modernizing and renovating show-window and sign lighting systems is just beginning. It's easy to add this G-E time switch to the wiring contract and get the extra profit. The nearest General Electric Supply Corporation store can tell you all about it—or ask your own supply house for more information. If you prefer, write General Electric Company, Schenectady, New York, and ask for Bulletin GEA-1427. It will give you complete information about Type T-44—information that may help you get some profitable, extra business.

Type T-44 general-purpose time switch — an easy and profitable addition to your window-wiring jobs

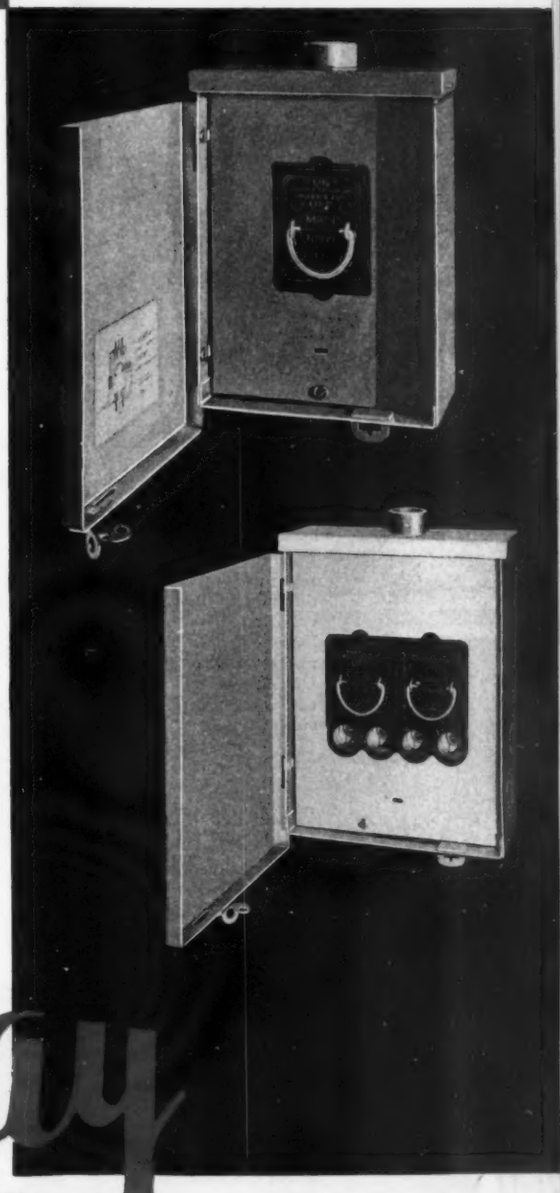
GENERAL ELECTRIC

Indoor and Outdoor

NEW, smaller, better looking — with years-ahead *interior* design (left), giving much more wiring space than other types. Available as service *or* range switches, — or for service *and* range duty, (1) with a single switch for either; also (2) with separate switches, one for service and one for range duty; (3) with or without branch lighting circuits.

OUTDOOR types (right) differ from indoor only in box construction. The door, in closing, is slid *up* under the "roof," which overhangs the sides so deeply that the hardest storms stay out. Indoor and outdoor types equally easy to install.

SWITCH units of one-piece Bakelite — compact and practically indestructible. It is impossible to insert the pull-outs incorrectly. Metropolitan Device Corporation, Brooklyn, N. Y.



Murray

PULL-OUT TYPE
RANGE & SERVICE SWITCHES

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

Send information on pull-out type switches, as well as catalog of Murray Switches.

Name_____

Company_____

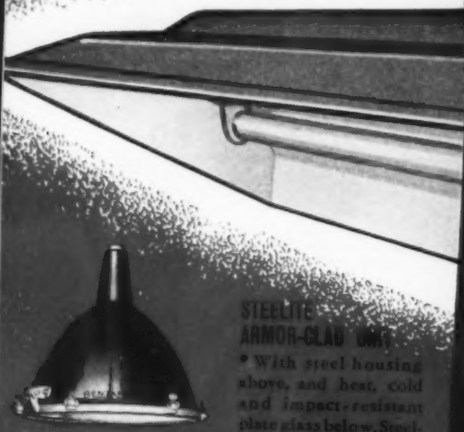
Address_____

Mail for Switch Catg.

• Made to RLM specifications, this porcelain enamel reflector is one of the most widely used lighting units in industry. Provides wide, even distribution of light characterized by good diffusion and soft shadows. Available with Turnlux hoods which reduce maintenance cost and facilitate easy clean-

GOOD OVERHEAD GENERAL LIGHTING FOR MOST FACTORY PRODUCTION AREAS PROVIDED BY BENJAMIN RLM DOME REFLECTORS. NOTE EVENNESS OF ILLUMINATION

• Rated vapor-proof by Underwriters' Laboratories, this Benjamin "Sealed-Flo" embodies the characteristics of the Benjamin Streamliter design and, in addition, has a one-piece housing sealed with gasket-equipped glass cover. The Cover is available in clear, opal or impact-resistant glass. Furnished in single, two or three lamp units for both general and localized illumination of industrial and commercial interiors.



ILLUSTRATING THE SOFT, GLARELESS QUALITY OF BENJAMIN STREAMLITER FLUORESCENT LIGHTING IN LOCATIONS WHERE SEVERE SEEING TASKS ARE PERFORMED

STEELITE ARMOR-CLAD UNIT

• With steel housing above, and heat, cold and impact-resistant plate glass below, Steelite is ideal for heavy industry's severest service. Choice of concentrating, medium and wide-spread Alzak aluminum reflectors.

UNIFORM LIGHTING OF STOCK ROOMS WITH BENJAMIN STOCK-BIN-LITE

STOCK-BIN-LITE REFLECTOR

• Unique reflector design provides uniform light for stock bins, tool cribs, warehouses, etc. Deflector directs light upward above cutoff. Openings in ends build up illumination between units.

↑ LIGHTING HIGH BAY AREAS WITH UNITS SUCH AS BENJAMIN STEELITE

HOW TO LIGHT YARDS AND OUTSIDE AREAS TO PREVENT SABOTAGE AND PROVIDE "DAYTIME" WORKING CONDITIONS FOR THE EXTRA SHIFTS ↓

"ALZO-LITE" FLOODLIGHT . . .

Has a unique hinged glass cover which protects reflector surface from rain, mist, fog, dust and smoke.

"DUO-SERVICE" FLOODLIGHT . . .

Combines porcelain enamel and Alzak aluminum reflectors for wide-spread ground coverage and spot-lighting certain areas for protection of yards, grounds and buildings.

FLUR-O-LITER ALZAK ALUMINUM FLUORESCENT UNITS

• Available for two or three 48-inch, 40-watt lamps, the Flur-O-Liters are designed for local illumination over machines and benches or high mounting general lighting of entire rooms. Individual polished Alzak aluminum reflectors adequately shield lamps. Equipped with renewable lamp starters and high power factor auxiliaries which reduce flicker. Bears Underwriters' approval label.

WARRANTY OF PERFORMANCE AND CONSTRUCTION

• All Benjamin Fluorescent units are designed to give the highest light output efficiency and are warranted by Benjamin to comply with all recognized safety requirements, electrical, illumination and mechanical standards. They are certified to meet with the requirements of the Underwriters' Laboratories as evidenced by the UL inspection label affixed to each unit.

TO GUARD AGAINST SABOTAGE, USE BENJAMIN FLOODLIGHTING . . . BUILD A PROTECTIVE FENCE OF LIGHT AROUND YOUR PLANT

• Whenever it is desirable or necessary to guard against the activities of saboteurs, prowlers and others attempting unauthorized entry or bent upon destruction, floodlighting plant yards, passageways and approaches is recommended as a protective measure. Moreover, such floodlighting protects against accidents outdoors at night and is successfully used for the improvement of public relations.

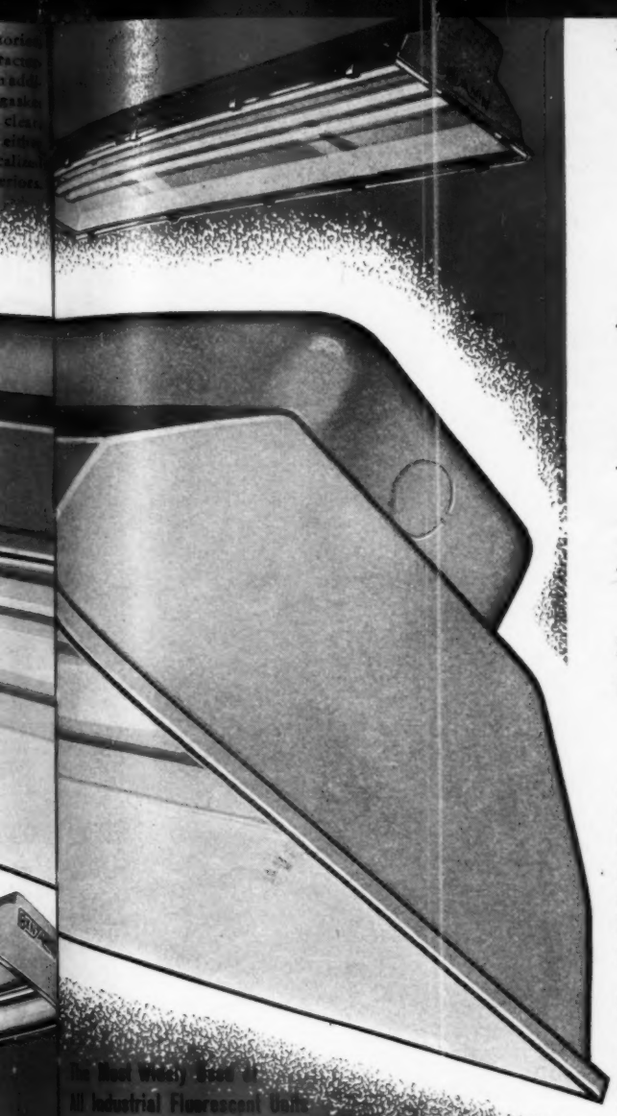
• Benjamin floodlights and other outdoor lighting units are designed to supply the proper amount and kind of light for the requirements of various locations and applications. Two of the many different types and sizes of Benjamin floodlights are shown to the right. Mail Coupon for complete information.

TAKE THIS IMPORTANT STEP NOW TO

MAKE SURE YOUR PLANT AND OFFICE LIGHTING IS "TOOLED UP"

TO MEET THE NEW PRODUCTION DEMANDS

SEND TODAY for Complete Data on How to "Tool Up" for Uniform Seeing Efficiency for All Employees, At All times, In Every Department of Plant and Office.



THE BENJAMIN RLM STREAM-LITER

● Made of Benjamin Lifetime porcelain enamel, the Streamliter is designed for general illumination with 48", 40-watt lamps and features 78% light output efficiency, 72½ degree cutoff angle and closed end lamp shielding. Equipped with renewable lamp starters and high power factor auxiliaries which minimize flicker. Made in accordance with RLM Standard Specifications and carries the RLM Label.

AVAILABLE SOON! NEW BENJAMIN UNIT FOR NEW 60" FLUORESCENT LAMPS

● A new Fluorescent unit designed and constructed to high Benjamin standards for use with the new 60" Fluorescent lamp. This unit provides especially high levels of Fluorescent Lighting for general or localized illumination of factory interiors.

● Shown here are some of the many Benjamin Lighting Units which can be used in "tooling up" your plant and office lighting to prepare it for the new production demands resulting directly or indirectly from the National Defense Program.

WHY "TOOLED UP" LIGHTING PAYS

● When these Benjamin units are properly fitted to both the Seeing and Physical requirements of your various locations and operations, the time now being wasted in trying to see under inadequate light can be saved to increase the *quantity and maintain or improve the quality of production.* (An increase in illumination from one foot candle to twenty triples the speed of seeing!)

● With Fall and Winter will come dark days, and the possibilities of extra shifts—it is important, therefore, that you make sure now that your plant and office lighting are "tooled up" to meet every exigency, so that increased production can be maintained without affecting the uniformity of product quality.

● First step is to request copies of the new Benjamin Bulletins on the types of lighting in which you are particularly interested . . . Plant Lighting, Office Lighting, Fluorescent Lighting, Protective Floodlighting. These Bulletins will give you much valuable data for use in checking your present lighting system or planning lighting for new buildings. It gives you the answers to many important questions such as how to select the proper lighting units . . . when and where to use Fluorescent Lighting and the importance of observing the fundamental principles of illumination.

HOW TO GET FREE DATA BULLETINS

● You may secure copies of these Data Bulletins from your Electrical Wholesaler, your local Electrical Contractor, the Benjamin Field and Engineering Organization, or to make sure you will receive the Data Bulletins immediately, mail the coupon below or address a letter to the Benjamin Electric Mfg. Co., Des Plaines, Illinois.

BENJAMIN

TRADE MARK

LIGHTING EQUIPMENT

Distributed Exclusively Through Electrical Wholesalers

ATTENTION CONTRACTORS!

This message which is appearing in the September issues of leading industrial and electrical magazines on the subject of "tooling up" the lighting to meet the new production demands occasioned by the National Defense Program should be brought to the attention of your clientele. If you do not have copies of the various Data Bulletins discussed in this advertisement, or would like the aid of the Benjamin Field and Engineering Service in the solution of specific lighting problems, be sure to write the Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois, or see your Benjamin Electrical Wholesaler.

YOUNGSTOWN "BUCKEYE CONDUIT" IS LIKE AN EXTRA HELPER ON THE JOB

Made from a steel developed for this work alone, the conduit has a ductility which is uniform throughout each length. Work with a hickey is fast and quick. Your workmen can make real time when the conduit bends on comparable radii with the same flexibility and there's no back lash in the pipe. Threads, cut once, are clean, need no chasing.

Buckeye Conduit is lined with satin-smooth lacquer lining, flexible but tough. Fish wires won't scratch through, and when you push cable on short runs, there will be no cracked lining to fight.

Speed on a job means profit, and Youngstown Buckeye Conduit is the first step to making time and saving money on any installation.

BUCKEYE TRADE MARK YOUNGSTOWN CONDUIT

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - - - YOUNGSTOWN, OHIO

Ask your distributor for Youngstown Conduit - Pipe and Tubular Products - Sheets - Plates - Tin Plate - Bars - Rods - Wire - Nails - Tie Plates and Spikes.

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YOUNGSTOWN

electrical contracting

With which is consolidated The Electragist and Electrical Record
Established 1901

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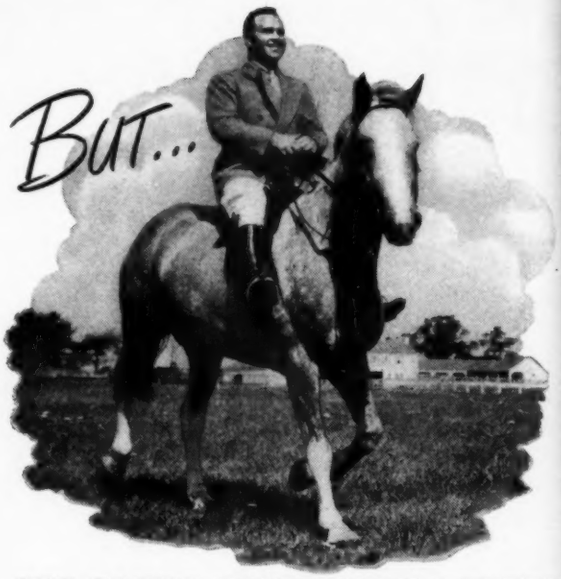
A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction—industrial, commercial, and residential.

McGRAW-HILL PUBLISHING COMPANY, INC.
JAMES H. McGRAW, Founder and Honorary Chairman
Publication Office, 99-129 North Broadway, Albany, N. Y.
Editorial and Executive Offices, 330 W. 42nd St., New York, N. Y.

JAMES H. McGRAW, JR., President; HOWARD EHRLICH, Executive Vice-President; MASON BRITTON, Vice-Chairman; B. R. PUTNAM, Treasurer; D. C. McGRAW, Secretary; J. E. BLACKBURN, JR., Director of Circulation. *Branch Offices:* 520 North Michigan Ave., Chicago; 68 Post St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta. Published monthly, price 25 cents a copy. Vol. 39, No. 9. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription Rates—U. S. A., Canada and Latin-American republics, $2.00 a year, $3.00 for two years, $4.00 for three years. Great Britain and British Possessions 18 shillings for one year, 36 shillings for three years. All other countries $3.00 a year, $6.00 for three years. Entered as second-class matter August 29, 1936, at Post Office at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. Copyright 1940, by McGraw-Hill Publishing Company. Cable address: "McGrawhill, New York." Member A. B. P. Member A. B. C.

You can ride BAREBACK



IT'S EASIER GOING WITH A SADDLE

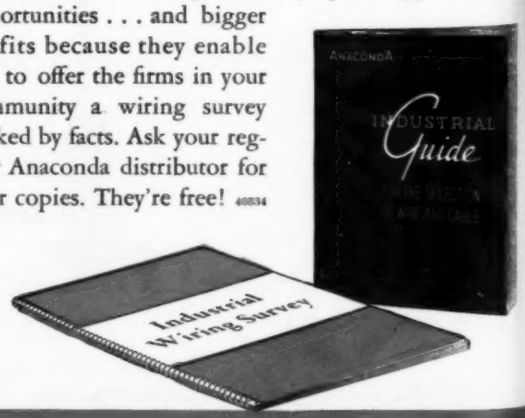
•

Smooth out the Ups and Downs in Your Business!

It's a lot easier to build new business . . . steadier and bigger electrical profits when you *use* those two handy, helpful little sales stimulators Anaconda has prepared especially for you.

They're called the "Industrial Wiring Survey" and the "Industrial Wiring Guide." Right now they're more valuable to you than ever. Why? Because today—according to authorities—nine out of ten industrial plants are in need of new wiring. Old, worn out circuits, overloading and failure to provide adequately for new equipment mean wasted money and possible electrical failure. What's more, most plant supervisors aren't aware of these conditions.

That's where you—the Survey and the Guide come in. The Survey enables you to make a step-by-step check-up of industrial circuits; the Guide to correct the conditions found. Together they spell bigger wiring opportunities . . . and bigger profits because they enable you to offer the firms in your community a wiring survey backed by facts. Ask your regular Anaconda distributor for your copies. They're free! 40834



USE MODERN IMPROVED **Anaconda Wire & Cable**

ANACONDA WIRE & CABLE COMPANY, General Offices: 25 Broadway, New York City; Chicago Office: 20 North Wacker Drive

Subsidiary of Anaconda Copper Mining Company. Sales Offices in Principal Cities

electrical contracting

SEPTEMBER, 1940

Like Legs

ONE OF NEW YORK'S FIRST FAMOUS SKY SCRAPERS was the Flatiron Building at Madison Square. On windy days, the men crowded the corner to see the gals walk by. For the mighty gusts would shoot their petticoats knee high or higher. Everybody got a big thrill—including the gals, I guess, or they would have crossed a block beyond.

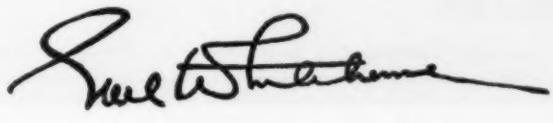
WELL, THE WIND STILL BLOWS at the Flatiron Building but it is not the same. After years of silk stockings and short skirts, legs have become commonplace. Interest has waned. Nobody cares. And so it is with the commonplace in life—in business.

TAKE THE BUYING FUNCTION in the electrical construction business, for example. It is generally neglected. Somebody is put in charge. He proceeds to purchase the materials we habitually use. He orders in quantities needed for the job or to maintain the stock. The process is reduced to dull routine.

BUT THERE IS MORE TO BUYING THAN JUST THAT. And every electrical contractor and industrial plant electrician knows it. The selection of equipment is vital, in the planning and selling of construction—to make a better installation, to speed the work, to give distinction to the job, to render a more helpful buying service to the customer or the management. It is vital in making profits and in building a good reputation.

A RECENT SURVEY AMONG ARCHITECTS shows that 87 per cent specify standard electrical products by brand or manufacturer's name. But of these, 80 per cent carry an "or equal" clause in their specifications. That means that the door is wide open for a more effective purchasing service on electrical construction. For what "or equal" really means is "or better for the job." It is an invitation to superior selection of products, and the improvement of design.

LEGS MAY HAVE BECOME COMMONPLACE but they still have lost none of their importance. Buying is no more familiar than selling, though selling may offer more variety and excitement. Electrical manufacturers have developed a broad and complete line of materials and equipment for our use, too complete in fact. But the average buyer uses too little of it for his own good—and his customers'. And thereby we throw away one of our best aids to our selling and our service.



See your way to new profits via FLUORESCENT light

...Get the story Complete from your Graybar lighting specialist

Right now, buyers everywhere are highly receptive to the idea of lighting modernization using the new fluorescent lamps. Profitable equipment sales and installation contracts are waiting for the man who *knows the whole story* on fluorescents. For sales to stores, offices and industrial plants particularly, you'll need all the facts — all the "do's-and-don'ts," and an up-to-the-minute picture of the reflectors and accessories currently available.

Why waste working time trying to "pick up" the story on fluorescents by piecemeal inquiry from conflicting sources? To see your way clear to fluorescent profits, call on your local GRAYBAR lighting specialist. You'll have a full range of the newest, soundest items to choose from, all backed by the satisfaction-insurance of the GRAYBAR Tag. Or write direct for information, mentioning type of application.

GENERAL ELECTRIC FLUORESCENT LAMPS

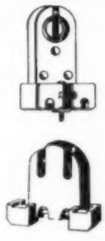
18-inch (15 watts); 24-inch (20 watts); 36-inch (30 watts); 48-inch (40 watts). In white, "daylight," and a wide range of colors for special purposes.

FLUORESCENT REFLECTORS

For Stores, Offices, Industrial Plants including Benjamin *"Streamliter,"* Wheeler *"Vapor-Proof,"* Curtis *"Curtistrip,"* Daybrite *"Commercial"* and other profit-making items.

AUXILIARIES AND SUPPLIES

A full line of approved equipment, including lampholders, starter switches, ballast transformers, and wiring supplies particularly adaptable to modern lighting installations.



"Everything Electrical"

GRAYBAR offers 60,000 items . . . everything electrical . . . the outstanding lines of merchandise and supplies from 200 leading manufacturers. Prompt shipment from 82 warehouses, coast-to-coast.

GraybaR
HEADQUARTERS for FLUORESCENT
LAMPS—ACCESSORIES—REFLECTORS

GraybaR QUALITY SINCE 1869 *Everything Electrical* GraybaR ELECTRIC COMPANY

"With the information I got from GRAYBAR, I was able to get enough fluorescent business to become the 'fluorescent specialist' in this town."

—says Contractor R———— J————

(No. 9 of a series of 10-second "quotes" from typical Graybar customers.)

OFFICES IN 82 PRINCIPAL CITIES
EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.

CHALLENGE TO INDUSTRY'S PATRIOTISM

Calls for Plain Speaking

IT is a pity that the greatest national defense effort in American history had to be made during a presidential election campaign. For a modern defense effort involves an intensely practical industrial project, while an election campaign involves an intensely emotional political propaganda. And those two don't mix.

That, as I see it, is the chief reason for the welter of claims and denials, charges and counter-charges that have been getting in the way of contracts for planes, tanks, guns and all the rest of the armament for which the American people are so nervously peering down the road.

We are told that the managers of industry, smarting and suspicious under the repeated attacks of government officials for some years back, have been reluctant to assume the abnormal risks of defense contracts without commensurate safeguards, and that the politicians who must authorize those safeguards have been reluctant to do anything that might be construed as letting down the bars for unscrupulous business men to exploit the national emergency. For the one, the business risks of full speed ahead have been too great; for the other, the political risks of full speed ahead have been too great. So we don't go full speed ahead.

This is not written to increase that clamor of recrimination on either side. On the contrary, it is an appeal for some decent and thoughtful consideration on the part of all concerned—consideration for the urgent needs of the nation, for the problems and responsibilities of both the politicians and the industrialists, for the elementary principles of prudent business management, and for the good opinion of the man on the street. He is neither a politician nor an industrial executive. But his hide and his pocketbook are at stake in the national defense program—and he knows it. He has a right to the low-down on what is going on. And if he is left in ignorance or deliberately deceived, for the sake of either political or business whoopee, the payoff will be mighty poisonous political medicine for the politicians and equally poisonous business medicine for the business men who may be responsible.

* * *

The plain stark fact, to be faced squarely by us all, is that the national defense program is an emergency project—a desperately urgent emergency project.

As in every emergency that confronts a democracy, we are harassed by a confusion of counsel. As always, some of the confusion arises from honest but conflicting judgments, some of it from ignorance or muddy thinking. But, unhappily, much of it reflects the deliberate purpose of self-seekers to fish in troubled waters—to capitalize the conjunction of a national emergency and a political campaign to boost their own interests. Already the charge that American business men are unpatriotic and interested only in profit has been put out as a smokescreen to cover up deficiencies for which business men are in no way responsible.

Now the man on the street finds it hard to see through this maze of excited contradiction. Not because he isn't smart—the average American can think straight enough *when he has the facts*. But in this case the facts are obscure and complicated—they have to do with matters that are strange to him. And to make it worse, at the height of his confusion, raucous voices constantly assail his ear with "simple" explanations of it all. But, as so often happens, most of these "simple" explanations make the matter a lot simpler than it really is.

* * *

Consider, for example, the cry that "industry refuses to get busy on national defense until its profits are guaranteed". Very clear and simple, to be sure; but also very false. The charge that American capital is "on strike" in the hour of national need. As silly as it is simple. The assertion that our manufacturers "won't even talk with a government anxious to place orders with them, without large financial concessions", and that "American corporate industry refuses to expand its resources for defense until it receives immunity from proper taxation". The resounding demand that we "conscript wealth as well as men"—whatever that may mean.

Particularly political has been the attack on the aircraft industry. It has been made to appear that aircraft manufacturers were instituting a sit-down strike because, in their greed for profits, they demanded more than 8%. Actually the 8% was not a net profit at all and the only concern of the manufacturers was to fight against incurring losses under the 8% limitation. And army and navy officers have sustained the aircraft manufacturers' viewpoint.

The air is full of explanations which, however simple they may sound, do not explain. And in most cases, I am convinced, the purpose of those who offer them is not to explain but to inflame. Those who try honestly to explain these issues from either side, find it impossible to do the job in such ringing phrases.

As I have said, our country has been caught short. As

a result, there are many reasons for the confusion and controversy. The plain fact is that we can produce our war equipment by only two means: (1) by converting the industries of peace into the industries of war, so far as that is possible; and (2) by building from scratch the new facilities we need to supplement them. In other words, we must create—with desperate haste—a new industry in America—an armament industry.

Right there is the crux of the problem that now confronts the industrialist sincerely trying to equip himself for his part in national defense. For this new armament industry is not the ordinary business risk against which he has learned to weigh the interests of his employees and his stockholders. It does not deal with familiar products and processes. It is not continuous—at least it has not been heretofore in this country—and it may fold up as suddenly as it has opened. It cannot hope to serve thousands of potential customers: it has but one sure customer—the United States Government—and wielding the sovereign power that customer can do just about as it pleases with respect to its needs and demands. Which means that not even this one is a *sure* customer.

* * *

No more unfair or deceptive charge ever has been leveled against American industry and American business men than the accusation of being unwilling to take the normal business risks of the defense program. The risks they are trying to minimize—they cannot possibly avoid them all—are very special and extraordinary risks indeed. So clearly is that true, that I doubt very much whether such questions and charges ever would have risen were it not for the fact we are engaged in a political campaign.

Already some of industry's great units have gone ahead with the building of new facilities, the purchase of special materials, and the actual production of armament in the face of all risks, gambling that their government eventually would work out some reasonable plan to protect them against excessive loss. Others, doubtless will follow suit.

But many other companies, for one reason or another, are not in position to do that. So before they begin to expand their facilities to handle defense contracts, they have asked their *only potential customer for those new facilities* to guarantee them—*not* excessive prices, *not* exorbitant profits, *not* immunity from taxation, as we are being told, but simply against the excessive losses that may result from very extraordinary conditions.

* * *

As this is written, it looks as though the legislation and the rulings necessary to accomplish this purpose soon will be forthcoming. Thoughtful and responsible officials of the government understand the situation and what is needed. But, unfortunately, their understanding and action will not quiet the professional business-baiters. So long as those gentlemen have their own interests to serve, so long as political excitement makes it easy to whip up public demand for a scapegoat to atone for disappointing progress with the defense program—just so long will the business-baiters find a receptive audience for their criticisms.

All of which suggests that business men must carry at this time a double responsibility, in addition to their obvious obligation to do the very best job they know how on their individual parts of the defense program.

The first of these added responsibilities is, of course, to avoid any possible basis for the charge that industry is exploiting the defense program in behalf of excessive profit, unfair treatment of labor or any other unworthy self-interest. The second is to see that the man in the street knows and understands all that I have tried to set down in the foregoing.

For the man in the street is deeply involved in all this. He is "in the street" only to the political orators. To the rest of us, he is the man in the factory, the man on the truck, and the man behind the orders that industry fills. In short, he makes up this living American industry on whom the politician's charges spatter. As an employee he has a stake in the solvency, the security, and the reputation of the very plants at which criticism may be directed. Knowing the facts, he can answer the critics so far as his own plant is concerned and can see how the same kinds of facts apply to all industry. If he is a customer, suffering inconvenience as a result of the plant's service to national defense, a knowledge of the facts behind the plant's problems will help to make him a defender rather than a critic of responsible business management. If he is a neighbor in the community, the facts will equip him to be an interpreter of industry's problems to the people of the home town.

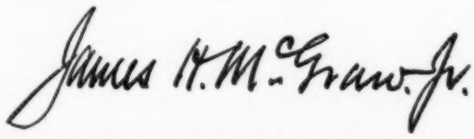
* * *

In this national defense effort, business enters into a new partnership with government, but, more importantly, into a deeper partnership with the American people. It is more than ever essential that it take all of the American people into its confidence, beginning with the people in its plants and going out through the ranks of its customers and its community neighbors to show them that they have a common interest in seeing that the task of national defense is undertaken in the American way.

As we all know, there are in this country some people who would like nothing better than to see American industry fail in this supreme test of service to the nation. They will watch with jealous eyes every move of every company that is engaged on a defense job. They will disparage its achievements, exaggerate its shortcomings, and distort its motives. For they would like to make over American industry to their own pattern, and they'll never have a better chance to get started with it than has been opened up by the national emergency. Or so it looks to them.

So, great as are the business hazards of the defense program for the individual business man, even greater hazards are involved for American industry as a whole. But, knowing the temper of American industrial leadership as I do, I am confident that it will handle its defense assignment with credit to itself and with great advantage to the nation that it serves—whether in war or in peace.

To help in that supreme test is the opportunity and the privilege of the McGraw-Hill organization.



President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

ASBESTOS-CEMENT CONDUITS *enter a concrete manhole in the underground distribution at the Federal Yeast plant in Baltimore. Ducts are buried directly in the earth.*

UNDERGROUND Wiring Methods

There are many cases where underground distribution can be introduced to make a better and more profitable job. Here is a brief review of the applications and installation technique for the methods commonly used. There are many interesting ideas for contractors who are both experienced and inexperienced in this type of work.

UNDERGROUND distribution of electrical systems—power, light, signal and communication—is being used more extensively every day. "Let's put it in the ground and get it out of the way." And if spare ducts are installed it will be a snap to pull in an additional circuit or two in the future." Those are the thoughts of the engineers and contractors who design and install modern distribution systems.

This type of distribution has a wide field of application including—

1. *Industrial Plants* — Transformer, switchboard and distribution work in and between buildings for power, light, signal and communication; protective lighting.

2. *Commercial Buildings* — Power, light, signal and communication service and inter-building distribution.

3. *Institutions*—Power, light, signal and communication between buildings; ground lighting.

4. *Airports*—Power and light service and distribution; runway, field, beacon and boundary lighting; signal circuits.

5. *Homes and Estates*—Service connections; service to garages, barns, equipment; ground lighting, protective and decorative.

6. *Cities and Municipalities* — Fire and police alarm systems; traffic light systems; street, highway and parkway lighting.

7. *Railroads*—Power and signal systems.

8. *Utilities*—Primary and secondary distribution systems; generating and substation work.

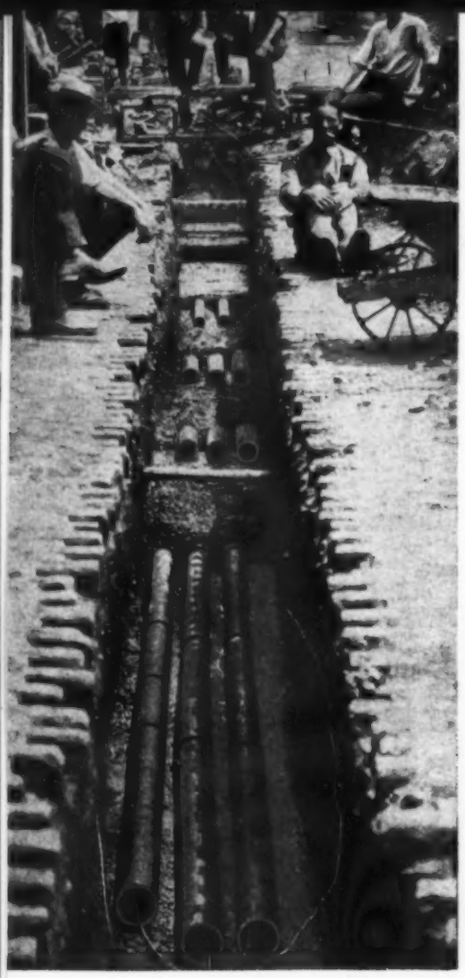
9. *Rural* Locations—Distribution and subdistribution for real estate developments.

10. *Telephone Companies* — Distribution and service entrances.

For these various applications there are a number of different methods of underground distribution in common use. The type chosen depends mainly on the economics and size of the job; permanence of installation; future needs; soil, moisture and corrosive conditions. The methods used fall into two distinct classifications — underground ducts with cables and cables buried didectly in the earth without any duct protection.

Underground Ducts

Under this classification there are six types of ducts that are commonly used. The types and recommended installation technique of each are discussed below—



TIER-BY-TIER *method of duct installation is built up in layers, the concrete being poured between each bank or tier until the proper separation is reached. This method is also used for duct buried directly in the earth.*

BUILT-UP *method of duct installation requires the number of tiers be placed in position before any concrete is poured. Precast, grooved spacers provide the proper separation and duct alignment.*

1. *Fibre Conduit* is used extensively for underground distribution work. It is constructed of a compound of coal tar pitch and felt fibre, which combination is said to be chemically inert and neutral. Thus it eliminates electrolytic action and resists acid and alkaline actions of ground moisture. This type of duct is furnished with a tapered coupling or socket joint for use where space is limited.

Fibre duct is available in two types. The standard type is for installation in a protective concrete envelop. The other has a much thicker wall and can be buried directly in the ground without concrete protection. This heavy wall product is being used extensively in small as well as large jobs.

In this particular product the economic turning point between the choice of the standard and heavy wall duct is approximately at four duct banks. That is, in systems under four ducts it is more economical to use the heavy wall duct without concrete. In systems of four ducts and over it is more economical to buy the protective strength in the concrete envelop.

2. *Asbestos—Cement Conduit* is also extensively used for underground distribution systems. This conduit is made of asbestos fibre and cement combined under high pressure to form a waterproof, corrosion resistant, fire retarding material. It is also immune to electrolysis and is non-inductive. This conduit is manufactured in two types—the heavy wall standard for use without an enclosing concrete envelop and the thin wall type for use with concrete. The standard heavy wall duct is also used for outdoor and indoor overhead and wall mounting. This duct has the tapered coupling joint.

The economic balance between the thick wall and thin wall duct is reached at approximately six duct banks. After six ducts it is more economical to buy strength in the concrete casing.

3. *Concrete Conduit* is manufactured in some parts of the country and is used mostly by utility companies. It is manufactured in two types—with the outer surface square or round. In some cases the square type is preferred for ease of installation. It stacks well and spacers and supports are eliminated. This conduit has a smooth inner surface and has a socket joint on the square and a coupling joint on the round type. A water-proof cement compound must be used at the joints. This type of conduit is comparatively heavy but inexpensive and the economics of the job dictates its use. Of course no concrete envelop is needed. One large utility finds it economical to use the square concrete conduit in banks up to six ducts. Then fibre or asbestos-cement in a concrete envelop is indicated.

4. *Tile Duct* is used mostly by the utility companies for distribution systems. It is rarely used in the type of underground distribution work the average electrical contractor would be called on to do.

5. *Pump Log or Wood Conduit* is just what its name implies—a wood duct with a square external cross section and a cylindrical bore in the center. It is usually made of southern yellow pine, creosoted to preserve its protective qualities, and has a socket joint.

This type of underground raceway is used mostly for low tension telephone, signal, control and communication work. It is rarely used for light and power distribution. In some cases it is used without creosoting for underground work—as in some lighting circuits at the New York World's Fair, where the installation is temporary.

6. *Steel Conduit* is still used for some underground distribution work especially for short runs or portions of other systems subject to unusually heavy stresses and strains, as under streets and highways. This is particularly true where pipe must be pushed under a roadway—such as traffic control circuits under highways. Short runs in industrial plants and gasoline stations are mostly done with rigid steel conduit.

In one parkway lighting installation steel conduit with a special finish and a tar compound coating was used. This type of installation, however, is usually made with a parkway cable or a non-metallic conduit system.

Underground Cables

These cables, buried directly in the earth without the protection of a raceway, are roughly divided into three different types—

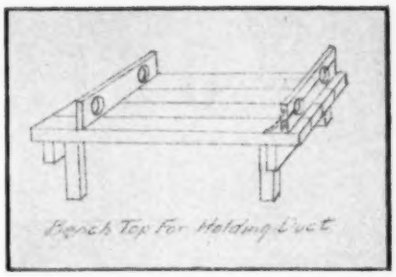
1. *Metallic-Sheath Cables* consist of rubber covered conductors in a lead sheath, flexible steel armor and an overall water resisting sheath. This type of cable is commonly known as "parkway

cable" and is used extensively in street lighting and other underground distribution where the possibility of additional load or circuit changes are remote. This system is also frequently employed in airport lighting, ground lighting of large estates, or for service to and control of remote equipment.

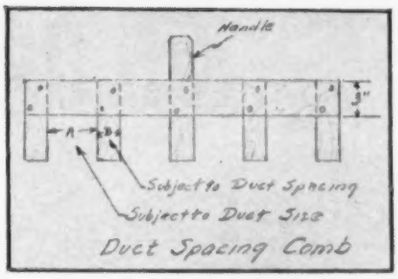
2. *Non-Metallic Sheath Cables* are of the same type of construction as the metallic sheath except the metal sheath on cable is eliminated. The applications are about the same as those for the metallic sheath cable but it should be used only in locations where there is little danger of mechanical injury to the cable after burial in the ground.

3. *All-Rubber Cables* can be buried directly in the ground or pulled into a raceway. They have an all rubber, moisture resistant covering unaffected by chemical conditions in soils and ducts. Cables of this type with oil resistant sheaths are also being developed and marketed. This type of cable avoids induced sheath losses, electrolysis, corrosion, crystallization and lack of flexibility—all troubles common with lead and other coverings.

These cables are now being used in some housing projects, real estate developments and industrial plants. In one manufacturing plant approximately two miles of this cable was installed to the deep water wells of the water system. One cable was used for service and a second one for control of the well pumps and auxiliary equipment. At the plant end of the circuits, they were spliced to lead covered cables in concrete enclosed fibre conduits.



BENCH TOP VISE *for holding the ducts to facilitate cutting. Hinged stock on right grips duct, stock on left keeps it steady. It can be easily made of wood.*



DUCT SPACING COMB *made of wood is used to insure alignment of duct during pouring or backfilling. Can be inexpensively made of scraps of wood.*

Installation Technique

Naturally the various characteristics of these different duct systems calls for different installation techniques. Broadly, it divides into two general methods—encasement in concrete and direct burial in the ground.

1. *Concrete Duct Encasements*—Fibre and asbestos-cement conduits may be installed in a concrete encasement by either of two methods (a) the "built-up or monolithic" method and (b) the "tier-by-tier" method.

In the "built-up" method the conduits are arranged in a self-supporting structure before the concrete is poured. Precast separators—or "spacers" as they are commonly called—are used between the ducts to maintain minimum distances and proper alignment. Sometimes this duct structure is placed on a tamped and leveled foundation layer of concrete. Frequently, however, precast spacers of the same thickness as the concrete base are laid on the trench bottom and concrete poured around and in the entire duct structure.

[Continued on page 86]

WIDE AND DEEP TRENCH *permits deep burial of this two-tier, 12 duct distribution system of asbestos-cement conduit at the State Hospital, Kankakee, Illinois. Concrete encasement is used only where duct crosses a driveway.*

STREET LIGHTING DISTRIBUTION *in asbestos-cement conduit at Kutztown, Pa. No concrete is used. Note how wire is pulled in duct, cut to length, then fished through the double elbow to light standard.*

FIBRE CONDUIT *without concrete envelop is installed in a three duct bank under a cobble stone street pavement. This was for a utility distribution system.*

KNOW Your CODE

A thorough understanding of the National Electrical Code is vital to everyone concerned with electrical wiring and apparatus. This article highlights the most important changes in the 1940 edition. Next month we will run a special editorial section devoted to a detailed analysis of these changes.

By John M. Turnbull
Service Engineer for the United Electric Company of Springfield, Mass.

SUBSTANTIAL changes in the National Electrical Code of the utmost importance to Contractors and the industry are embodied in the new Code, which will shortly be published. Conductors will no longer have only one value of current, but instead the current-carrying capacities of insulated wires will vary depending on (1) the grade of insulation, (2) whether installed in the open or enclosed in raceway or cable, (3) the number of wires in the raceway or cable, and (4) the room temperature. As to its form, the 1940 Code will fol-

PRINCIPAL CODE CHANGES IN BRIEF

CONDUCTOR INSULATIONS — From 7 types in 1937 to 19 types in 1940, including synthetics.

THIN-WALL INSULATIONS — Brand new. Four types; rubber recognized from No. 14 to 10 and 8, synthetic from No. 14 to 4/0.

"RE-WIRING" RULES — For increased load where space is not available in raceways.

CONDUIT FILL — 25% increase for rewiring with thinner insulations. From 40% in 1937 to 50% fill. 9 No. 14's types RU or SN in ½" c.

WIRING SYSTEMS — One added, Cellular Metal Floor Raceways; two dropped, Surface Wooden Raceways, Cast-in-Place Raceways.

FUSES — Type S tamper-resistant plug fuseholders to be mandatory in 1941.

BRANCH CIRCUITS — Watts-per-sq.-ft. rules extended to commercial occupancies. Common Neutral omitted.

FEEDER CALCULATIONS — Simplified. Feeder capacities to be calculated with same watts-per-sq.-ft. values as used for branch circuits.

RECEPTACLE CIRCUITS — At least No. 12 wire to be used to supply kitchen, laundry and dining room receptacles.

ENAMELLED CONDUIT — Not to be used outdoors.

MOTOR NAMEPLATES — Code letters on nameplates will limit size of branch circuit fuse.

GROUNDING PORTABLES — Portable equipment to be grounded when used in damp or wet locations.

SOLDERLESS CONNECTIONS — Soldered connections not to be used for connection of grounding conductors.

THIN-WALL INSULATIONS

SOME COMPARISONS OF INSTALLATION VALUES

AMPERES at 30 C. and not more than 3 Conductors in raceway

REGULAR		THIN-WALL CONDUCTOR TYPE LETTER		
R	WIRE SIZE	SN	RU RPT	RHT
15	No. 14	18	18	22
20	12	23	23	27
25	10	31	31	37
35	8	41		49
45	6	54	No larger sizes recognized	
52	5	63		
60	4	72		
69	3	83		
80	2	96		
91	1	110		
105	0	127		
120	00	145		
138	000	166		
160	0000	193		

Type SN not recognized over 4/0

NUMBER OF CONDUCTORS maximum in Conduit or Tubing

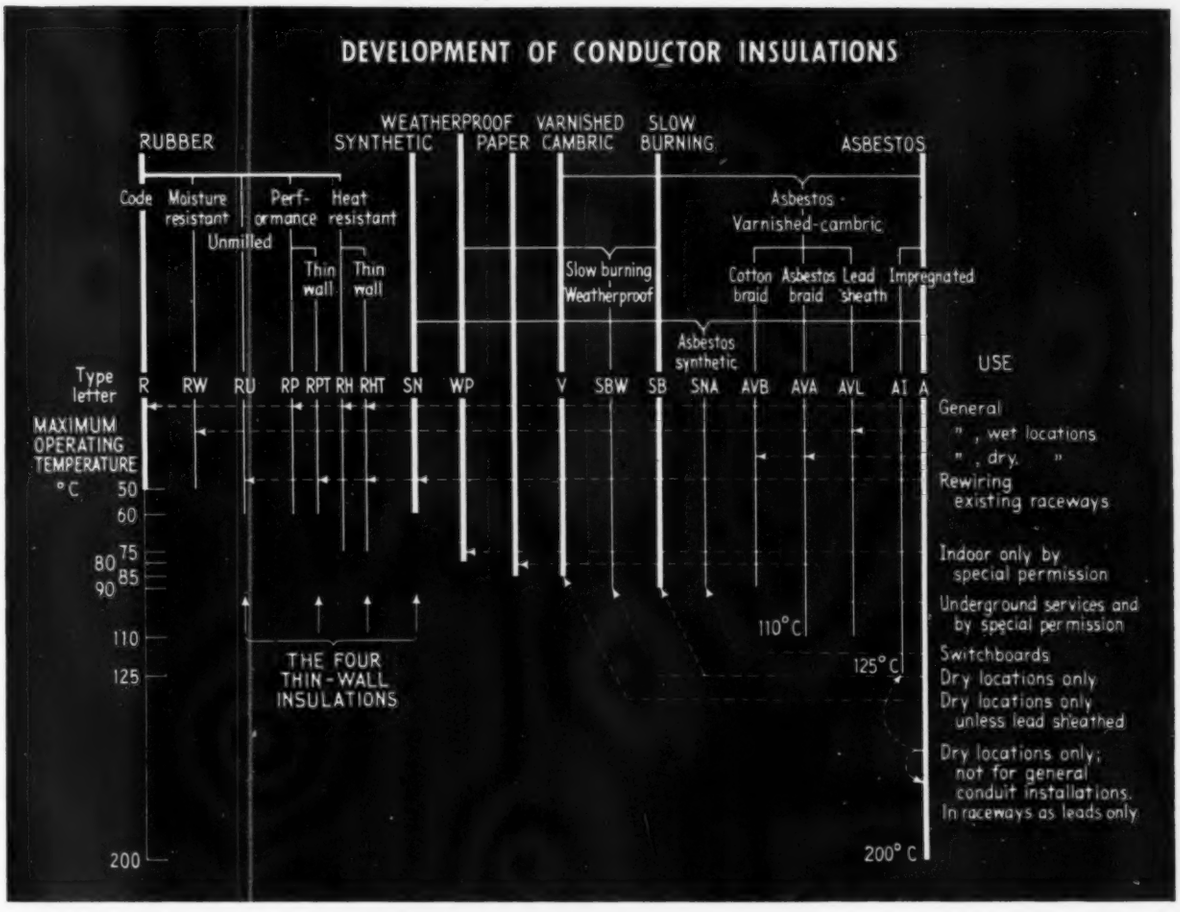
REGULAR		RE-WIRING	
R	CONDUIT SIZE	WIRE SIZE	RPT RHT	RU SN
4	½"	No. 14	7	9
3	½"	12	5	8
2	½"	10	4	6
7	¾"	14	9	—
5	¾"	12	9	9
4	¾"	10	8	9
9	1"	14	—	—
8*	1"	12	—	—
6	1"	10	9	—

*These values for rewiring only. Otherwise RHT same as type R.

DECREASE IN ALLOWABLE CURRENT-CARRYING CAPACITY

If more than 3 conductors in raceway or cable.

NUMBER CONDUCTORS	ALLOWABLE CAPACITY
1–3	100%
4–6	80%
7–9	70%



low the arrangement adopted in 1937, but with Chapters 9 and 10 interchanged to place all tables and diagrams at the very end of the book.

New utilizations, like high-voltage inside lighting, plus increasing loads will mean larger feeders and adequate branch circuits. Larger copper will result partly from the lowering of the values of current which may be carried on the larger sizes of conductors. For instance, a No. 4/0 with Code rubber will be rated at only 160 amperes; but, if "Heat Resistant" grade rubber were selected, the current could be increased to 230 amperes. The branch circuit changes will come about by the extension to commercial work of the watts-per-square-foot basis for calculating the required number of circuits.

Thin-wall insulations and increased allowable conduit fills on rewiring jobs will be new tools to open up the vast rewiring market, and should put much needed additional copper inside existing pipes. Thin-wall will make it possible to develop facilities without reconstruction and redecorating expense. Even though the new thin rubber coverings are to be permissible only up to No. 10 and 8 and synthetics up to No. 4/0, the market possibilities of say eight No. 12 wires in a ½-in. pipe are readily apparent.

Other Changes

Wiring methods change, so regulations will appear to govern the use of cellular metal floor raceways, while wooden raceways and cast-in-place raceways are dropped. Enamelled conduits and fittings will be prohibited outdoors. Type S plug fuseholders (tamper-resistant) will become mandatory in November 1941. More complete construction rules will be included for flush and recessed fixtures.

Attention has been given to the alarming rate of increase in the number of motor fires, and new limits on overcurrent ratings should provide more reliable protection to these circuits. An innovation will be those identifying letters on motor nameplates to show motor input with locked rotor. However, to the Code user this introduces its own slight complication in the motor tables, for as a consequence the largest permissible fuse will depend upon this motor code letter. Grade "A" motors will call for a smaller branch circuit fuse than say a "G" motor having twice the starting current.

Safeguarding of life will be increasingly taken care of by the grounding of portables, requirements for adequate working space around electrical equipment, and the further recognition of the interrupting capacity of apparatus.

Noteworthy among definition changes will be those for commercial garages (three or more vehicles), solderless connectors and dry, damp or wet locations, the latter applying particularly with the rearranged grounding rules of Article 250.

Accompanying illustrations show the 19 types of insulations, and how some of these fit into the new allowances for rewiring in existing raceways.

In the October issue we will devote a feature section to a detailed study of the principal changes which characterize the new Code. These changes will be graphically illustrated for easy reference and quick understanding.

Stepping Out With INSTRUMENTS

This company has reorganized its selling operation by the use of instruments to provide more facts to support its opinion and win the confidence of the customer—likewise to speed the work.

By Earl R. Eshleman
Electric Motor Corporation
Lancaster, Pa.

OUR company serves a central Pennsylvania city of 70,000, and this, with its trade area, has many industrial plants whose demands are not great enough to warrant an electrical department of their own. It is principally to these that we offer our specialized services in the installation, maintainance, and repair of electric motors and control.

Since the inception of our business we have made it a rule to find all possible facts back of our customer's troubles. To do this we have at our disposal a complete line of switchboard and portable indicating instruments.

It soon became apparent that these, while extremely useful, were not adequate to supply us with all the information, and that recording instruments were necessary. All factors were carefully considered to choose an instrument that would in itself have the greatest versatility, as it was not possible for us to purchase a complete set of these instruments at one time.

Our area is supplied with both direct and alternating current. The latter in single, two and three phase, in five voltages and two frequencies. Naturally this complicated our problem a great deal. Most instruments available were too expensive for us, or too complicated and troublesome for the average person to apply and use.

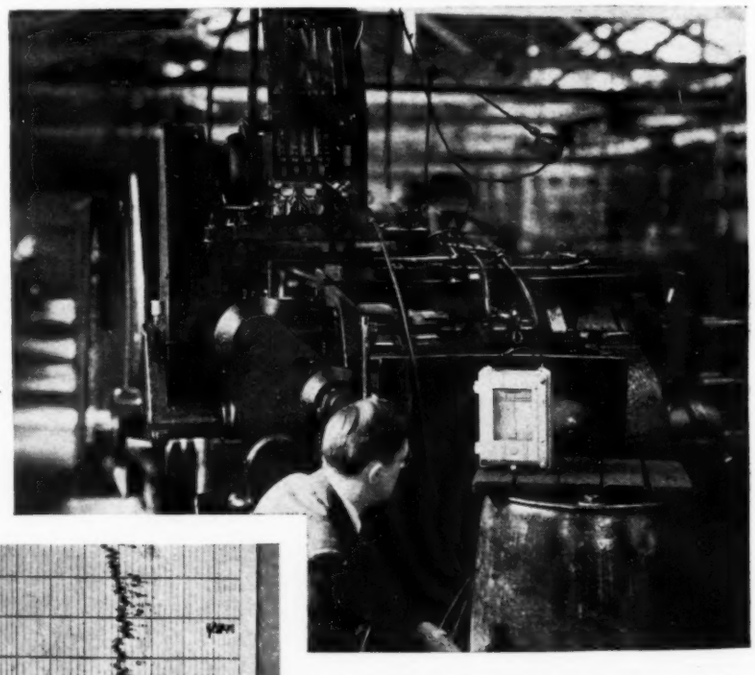
Recently a new recording instrument was placed on the market that seemed made to our order. It was first of all inexpensive. In addition to that it was not temperamental, was very rugged, weatherproof, and employed an inkless recording mechanism, and gave a clearly legible record permanently indicated regardless of load fluctuations.

In an accompanying photograph are three typical charts that clearly show this legibility. Chart 1 is a record of a widely fluctuating load of a group of motors totaling 215 hp., yet the current at any instant, or even maximum starting currents can easily be seen, as well as the duration of these currents. No. 2 is a record of a constant load on a ¼ hp. motor. This is an excellent example of how complete this information is. It gives definite running cycle, maximum starting current, and load variation from the beginning to the end of the run. Chart 3 shows the current drawn by a group of textile mill motors, representing a comparatively constant load with frequent starting periods.

We selected one of these recording ammeters, together with a split-core clamp-on current transformer several months ago, and it has been idle very little during this time. Two days after getting this ammeter and current transformer we got our first job for it, that of making a survey of the load and demand of a large feed mill. This job alone amounted to more than the cost of the equipment and resulted in a substantial monthly saving in energy cost for our customer.

The survey lasted five weeks during which time each major piece of equipment was metered separately for several days, as was the entire load and various group combinations. From our charts we were able to make out an operating schedule which reduced the maximum demand by 43 kw. Several machines were found to be over-motored resulting in bad power factor. Two were overloaded and another was found to

(Continued on Page 70)



PORTABLE RECORDING AMMETER *connected into a loaded motor circuit.*

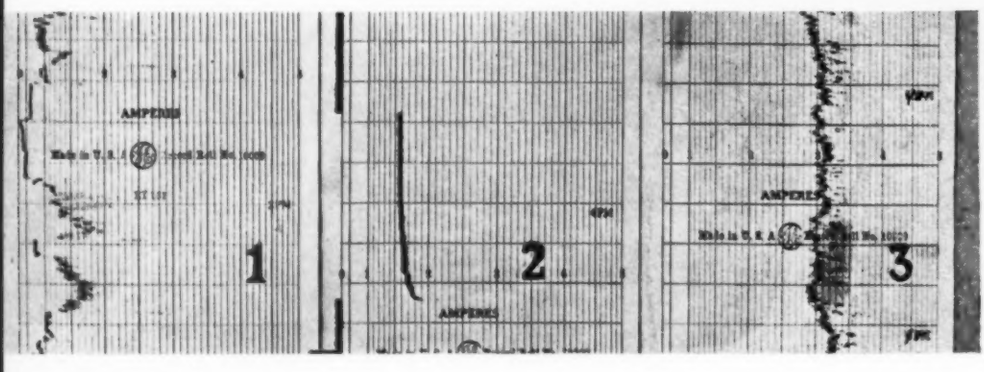


CHART *1 shows record of widely fluctuating load—Chart 2 the constant load—Chart 3 the current drawn by a group of textile mill motors.*

Fluorescent Floodlighting

Sixth in a series of articles on design and application of fluorescent lighting. A new method of floodlighting a building with fluorescent lamps applied to a Chicago utility property.

REFLECTOR TROUGH *with fluorescent lighting illuminates the face of the Northern Service Building of the Commonwealth Edison Company in Chicago. Conventional incandescent projectors on adjacent sections of the structure illuminate the other three sides of the shaft.*

FLOOD lighting walls of buildings which have no set backs, niches or ledges to accommodate light projectors has for years offered a challenge to the ingenuity of illuminating engineers. A significant solution to this problem has just been completed at the Northern Service Building of the Commonwealth Edison Company in Chicago.

Lower structures adjacent to the tower make it possible to use orthodox incandescent units for flood lighting three sides of the shaft, but the facade, rising sheer from the ground, has no appreciable architectural projections to permit the installation of lighting equipment. A unique treatment with fluorescent lighting was applied to solve the problem.

Four long vertical reflector channels were mounted 3 ft. out from the wall. Each reflector contains two parallel rows of 30 watt white fluorescent tubes and are faced with clear glass covers.

The reflector structures consist of four assemblies each approximately 72 ft. in length, secured to the building by eight structural steel supports. The positioning of the trough is such that the center line of the assembly coincides with the center line of the brick panel in which it is located. The bottom terminates approximately 16 ft. above the ground and the trough stands out from the building on metal brackets.

SECTIONS *of the floodlighting equipment, each 7 ft. long, are raised and lowered by a hand winch for servicing.*

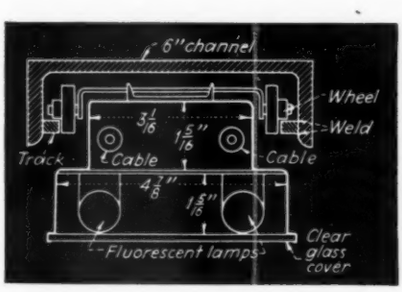
Within the trough is a series of reflector sections, each approximately 3-in. by 5-in. by 7 ft. long. Ten of these sections are coupled together and slide in a track which is integral with an outer enclosure which serves as an aligner. This is also a rigid means of supporting all the elements in the assembly.

For servicing, the sections are lowered within easy reach of the ground by a winch and cable which passes through the wall of the building out to the top of the assembly, then over a pulley to the upper section which is connected to all of the other sections and they to each other by mechanical couplings. When the lower section clears the raceway it may be uncoupled from the next section for relamping. Other sections may be successively lowered and serviced.

The sections are closed with a plate of double strength crystal glass. Each contains two compartments, the larger enclosing four 30 watt white fluorescent lamps plus a 10 watt heater for cold weather starting. The smaller contains the lamp auxiliaries and wiring. All sections are electrically fed from the lowermost section through a bus which continues from one section to another through contact pins in the end of each section. Each assembly is individually fed by a cable brought out from the building at the elevation of the lowest bracket.

For the other three sides of the tower 45 500-watt incandescent flood lights with asymmetric lenses and Alzak reflectors are grouped on lower buildings, 15 projectors lighting each of the three faces of the tower.

The watts per sq. ft. of fluorescent illumination on the East face of the tower is .84 and on the other three sides where incandescent equipment is used the load averages 3.1 watts per sq. ft. The color quality of the white fluorescent tubes effect an unusually attractive response from red brick walls, ordinarily considered rather difficult surfaces to light. The installation and design of this unique lighting job was made under the direction of E. D. Tillson of the Commonwealth Edison Company.



CROSS SECTION *of reflector section and supporting track.*

THE WAY *the floor appeared before rewiring with four 150-watt lamps in enclosing globes per bay, utilizing 2.4 watts per square foot.*

Creating *NEW*

A tenant in an office building in San Francisco tries the new small diameter wire and shows what can be done now in the correction of tight wires.

NEW small diameter wire was the determining factor in making possible an exceptional lighting installation on the second floor of No. 60 Sansome Street, an office building in San Francisco. Without it there could have been very little done. For the circuits were overloaded, the conduit was in concrete floor slabs and the cost of replacement of conduit runs would have been prohibitive.

Buzzell Electric Works, San Francisco contractors, had been working on the job for some months endeavoring to find ways to improve lighting within cost limits that were economical to the management of the building. Now an average of 45 foot-candle intensity has been provided in the 7,138 sq. ft. of space and there is wiring capacity at each outlet for increase in the future.

The main service to the building and the meter board had previously been increased to furnish a capacity of 5 watts per square foot for the entire seven floors and basement of the building. By changing the risers from 3 wire to 4 wire, capacity for more lighting was available. But the problem was one of getting that capacity to the existing outlets without extensive alterations to accommodate new conduits or without too many surface extensions.

Original lighting was from four 150-watt lamps in enclosing globes per bay utilizing 2.4 watts per square foot. Existing circuits consisted of two No. 12 wires in one-half inch conduit, with four lighting outlets and a varying number of convenience outlets on each circuit. These outlets were located in the same gang box as the switches controlling the lights. It was necessary to separate the lighting and convenience outlets and the only solution seemed to be to get special permission for greater conduit fill and to pull out the old two No. 12's, repull with two No. 14's for the lighting circuit and pull in two No. 12's for the outlets.

This wiring arrangement would have provided 15-amp. lighting circuits for the four 300-watt lamps per bay recommended by the lighting man. But the drop in voltage for the long No. 14 runs would have been excessive. From a lighting standpoint, this system would have fallen down badly in efficiency.

Fine cooperation between the engineer for the Northern California Electrical Bureau, W. C. Heston; the utility, Pacific Gas & Electric Company's lighting specialist Nathan Graves; Ralph Wiley, chief of the Department of Electricity of San Francisco, and Buzzell Electric Works, electrical contractor, persuaded the management to reconsider the job on the basis of full adequacy making use of the new small diameter wire.

With this it was possible to install two No. 12 and two No. 10 wires in the ½-in. conduit, the No. 10 wire being used on the lighting circuit. Thus the small diameter wire made possible No. 10 instead of No. 14 wire on lighting circuits, increasing the lumen output of lamps by just 10 per cent. This was an important increase in efficiency.

The contractor found a number of advantages in the use of small diameter wire. Surprisingly enough, the old wire, put in the building when first built in 1922, came out in excellent condition. There was no appreciable rust or adherence of the old conductor to the sidewalls of the conduit. The new wire went in very easily. The end which had been pulled in first and came out at the panelboard was found to be in excellent condition without any chafing. Only one short run of old wire was found to be difficult to pull out. In this case, there were two right angle bends.

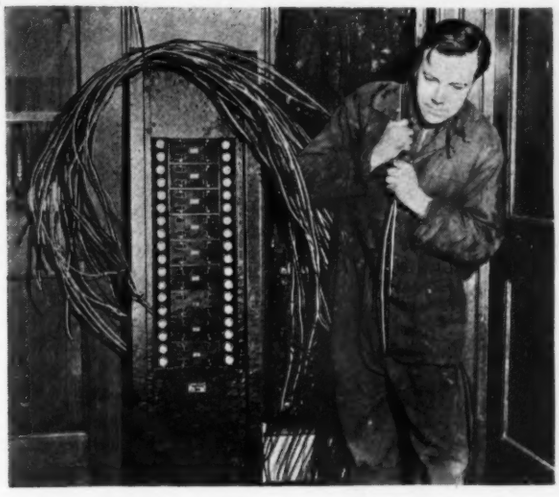
The only difficulties encountered had nothing to do with the mechanical quality of the wire. Rather, they were restrictions of the Code. For new extensions from existing outlets for the relocating of switches or of outlets, the new Code does not permit the new small diameter wire. In some instances

JOB DETAILS

AREA LIGHTED.....	7,138 sq. ft.
TOTAL WATTAGE...	28,950 watts
Watts utilized per sq. ft. (total area).	4.05
Watts utilized per sq. ft. (working area).....	5
Foot-candles per watt, initial, (working area).....	9
Average foot-candles.....	45
Minimum foot-candles.....	40
Maximum foot-candles.....	50
Ceiling height.....	11 ft. 9 in.
Ceiling color, white with tinge of blue	
Wall color, pale green	
Venetian blinds, white metal	
Type of luminaire, luminous indirect using 300-watt silver bowl lamps.	
Spacing of units.....	8.3 ft. x 8.5 ft.
Mounting height.....	9 ft. 3 in.
Lighting and wiring cost per sq. ft..	$0.36

RELIGHTED TO *foot-candle intensity of between 40 and 45 with a wattage per square foot of 5. Lighting was so good this photograph was a snapshot without additional lighting.*

THE NEW *36-circuit panel. The electrician found it easy to pull in the new small diameter wire.*



Capacity

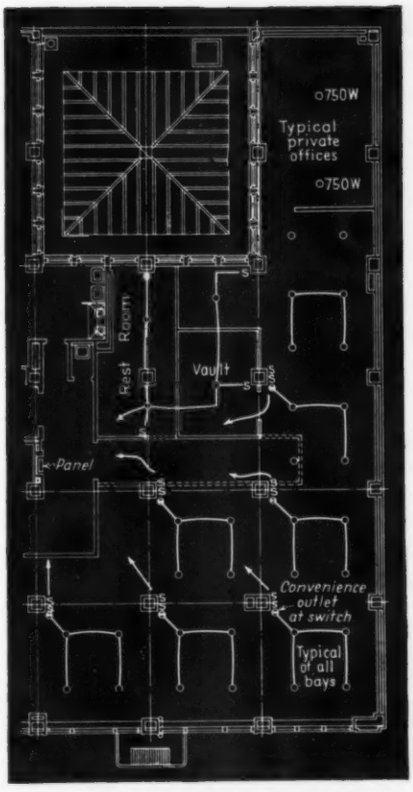
By W. A. CYR

where it worked to better advantage, special permission was given.

Along with the rewiring job, of course, was a refixturing job of considerable magnitude. The existing 150-watt enclosing globe units were replaced with 300-watt silver bowl Kurt Versen fixtures capable of taking 500-watt lamps later. In the private offices, 1,000-watt fixtures, lamped at 750 watts, were used. The 750-watt units were used in private offices of smaller size. Extensions to them were made in Wiremold on the slab ceilings.

All convenience outlets previously had been installed in the gang box at the switches. Many of these were relocated at some baseboard location. All the old 10-amp. switches were replaced with new 10-amp. switches and for the 750-watt lamps, 20 amp.-switches were installed. A new 36-circuit panelboard was installed for the floor.

Additional heat from the increased wattage of lamps has proved to be one of the problems and Buzzell Electric Co. will hereafter recommend that ventilation be taken into account in such rewiring jobs. In this installation two fans of the exhaust type were installed in dead corners of the floor and several fans were installed in connection with the steam radiators for better



PLAN VIEW *of one section of the rewired office showing the circuit and switch arrangements.*

heat distribution. Two circuits were also run for International Business Machines. Conduit was notched into the floor slab for telephone cross-overs.

The following table indicates roughly the allocation of costs on the job to the various items. The total job ran close to $3,500 and included some 15,000 ft. of small diameter wire.

	% of Materials Cost	% of Job Cost
Wire	19.4	13.9
Conduit	1.3	0.9
Panel Board	4.5	3.3
Fixtures	62.7	45.6
Lamps	7.2	5.3
Miscellaneous	4.9	3.5
Total Materials	100.0	72.5
Total Labor	37.8	27.5
Total Job		100.0

There were no local stocks of the new wire available on the Pacific Coast at the time the job started. By the time the stock had arrived, the painting had been finished on all floors and ceilings except where there were surface extensions. Even these had one coat of paint on them. The small diameter wire was pulled in after the painting had been finished without any damage to the painting. Also there was no damage to plaster or to other structural parts of the building.

Electrical

By A. A. Schuhler
Engineer, American District Telegraph Co. Washington D. C.

CONTROL DEVICES—*Control desk for burglar alarm and watchman's tour system (above) provides a complete protection for a factory. Waterflow valve switch (at left) sounds an alarm if the sprinkler system starts to discharge.*

IN awarding government contracts, industries involved are required to provide protection for formulas, specifications, drawings, plans, instruments and other equipment. This opens up opportunities for electrical contractors to install protection systems, such as burglar alarms, automatic sprinkler and waterflow alarms, automatic fire alarms, smoke detectors, watchman's tour and manual fire alarm systems. The automatic systems are preferable as they eliminate the human element to a large degree. Maximum dependability may be obtained in such systems when they are properly supervised and consistently maintained.

The Underwriters Laboratories list systems which are approved for specific protection problems, and in most cases carry substantial insurance credits. They break down broadly into these groups—

1. BURGLAR ALARM SYSTEMS

This type of protection may be applied to safes, storage or filing cabinets, vaults, rooms, yards, grounds, tunnels and waterfront properties. Burglar alarm systems protect the premises against attack and unlawful entry, provide the time element of delay in capturing the criminal, and guard against copying of formulas and drawings. They include—

Radio Frequency Field—Safes, storage or filing cabinets may be enveloped by a radio frequency field for complete protection. The alarm is transmitted when a person approaches the protected object with a pre-determined distance.

Wired Cabinets—Consist of a network of foil strips and associated wiring embedded within a wood cabinet enclosing the files to be protected. Timing devices will permit authorized persons to have access during pre-determined periods. The safe or cabinet must be insulated from the floor and connected to an antenna loop. Sensitivity is adjustable, also compensation against humidity and temperature conditions.

Sound Detection—Vaults may be protected by sound detection, wired screens, foiled panels, door and bolt contacts and heat detectors. The determining factor will be the construction of the vault. A vault of reinforced concrete may be protected by sound and heat detectors, and with door and bolt contacts. A lightly constructed vault of thin brick or tile may be protected with wired screens or foiled panels together with door and bolt contacts and heat detectors.

The sound detector system consists of ceiling mounted microphones adjusted to operate an alarm when a pre-determined number of sound impulses are picked up.

Heat Detectors—Operate when an attack is made by the torch. Timing devices permit authorized persons to have access during pre-determined periods. An emergency signal may be provided for protection where employees have been locked in. A method of testing the microphones with a sounding device is included to insure operation at all times. The use of wired screens and foiled panels on the ceiling, walls and floor prevents successful attack from these directions. Even though holes are drilled or bricks are removed, access to the interior is prevented by the protective network.

Photo-electric Rays—Are used successfully in room protection. Arrangements of the light rays permit coverage at one or more levels of an entire area. Light rays may also be directed to guard against deliberate removal of materials or equipment. The beams of light are invisible and may be redirected and reflected by means of mirrors between the light source and the photo-electric unit. A signal is directed when the beam of light is interrupted.

Yards and grounds also may be protected by the photo-electric system installed with weatherproof housings and designed to prevent undue false alarms caused by flying papers, birds and other animals traveling in the path of the light beams. Tunnels interconnecting buildings, carrying steam and water pipes, lines of communication, light and power networks, waterfronts, shipyards and docks may be covered very effectively by photo-electric systems.

2. . . AUTOMATIC WATERFLOW ALARM SYSTEMS

Many disastrous fires, caused by unsatisfactory sprinkler performance, have been traced to human carelessness or neglect. Valves may be closed in error.

Protection in These Times

A review of the more important protective equipment available for installation in industrial plants, where secrecy and security is necessary.

by accident, design or during the process of repair. Whatever the reason, a closed valve will prevent water from reaching a fire, even though the sprinkler heads open. Automatic supervision will cause an alarm to be transmitted when a change is made in the sprinkler system from normal to abnormal or the reverse.

Every point in the sprinkler system vital to the flow of water should be provided with tamper-proof switches or other contacts. This should cover the water supply sources as well as the sprinkler piping system itself. Supervisory detectors should be provided to initiate signals for any of the following conditions.

Closed shut-off valves.

Low water level in gravity tanks.

High or low water level in pressure tanks.

High or low pressure in pressure tanks.

High or low pressure in dry systems.

High or low temperature in gravity and surge tanks.

Low steam pressure in fire pump supply.

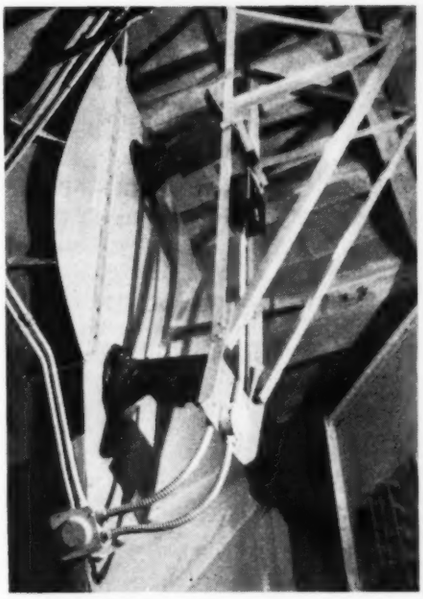
Failure of current supply to fire pump.

Alarm signals may be obtained in either coded or non-coded form with visual indication on an annunciator or recording device.

3. . . AUTOMATIC FIRE ALARM SYSTEMS

Automatic fire alarm systems may be used to cover large or small areas, such as offices, storage rooms, warehouses or filing rooms, particularly where sprinkler systems would ruin material in case of fire. These systems may be classed as rate-of-rise and the fixed temperature types. The rate-of-rise system operates when there is a rapid rise of temperature within a very short time. The fixed temperature system operates when the detectors are actuated by temperatures for which they are set—135 to 212 degrees F.

The rate-of-rise system may be the pneumatic tube type or a wired group of detectors. In the former, small copper or monel metal tubing of approxi-



SMOKE DETECTOR *system where light and photo-electric units are fitted into ventilation duct to give alarm should a fire start.*

mately 1/12 inch diameter is fastened to the ceiling or under the roof in a continuous loop or circuit properly spaced to cover a complete area. Both ends of the tubing of each circuit are then connected to a detector and successively to a transmitter and control panel. In the wired system, the detectors are mounted on the ceiling at intervals of approximately 30 feet, wired together to a transmitter and control panel. Annunciators may be added as a visual signal on either type of system.

In the fixed temperature systems the detectors are generally of the spot or bi-metallic unit type, or a thermal wire.

4. . . SMOKE DETECTION SYSTEM

Smoke detection systems are used in connection with air conditioning and ventilating duct systems. One of the most successful types operate with photo-electric equipment to detect smoke in ducts, stop blowers, close duct dampers and initiate alarms.

Smoke detectors should be located where they can supervise all of the air passing through the duct system, such as in the down-stream from the blower and filter. Dampers may be arranged to close automatically to limit the spread of smoke or fire.

5. . . WATCHMAN'S TOUR SYSTEMS

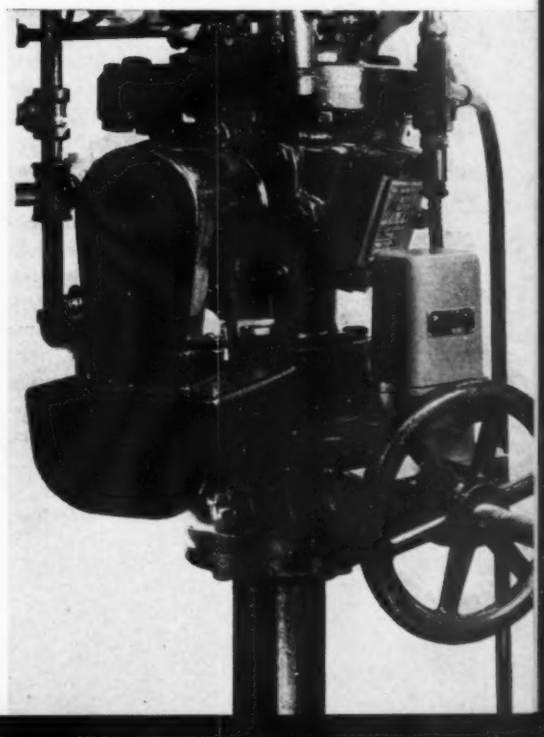
Most electrical contractors are familiar with the various types of watchman's tour systems. New features may be added to some old systems, such as a telephone circuit permitting the chief guard to call and signal any guard on his route. To do this a pilot light and a telephone jack is added to each watchman's station. Each guard is provided with a portable microphone which may be plugged into stations on his route.

6. . . MANUAL FIRE ALARM SYSTEMS

Most modern industrial plants are equipped with various types of manual fire alarm systems. But there are often possibilities of extending and improving these facilities. Any of the automatic systems referred to in previous sections of this article may be interconnected with the present equipment. Some of the old systems, of course, may have become obsolete and may require replacement.

In addition to the interior fire alarm bells, the circuits may be extended so that in case of fire the factory steam whistle will sound a signal.

SUPERVISORY SWITCH *on gate valve to give notice should valve be closed.*



Earl Whitehorne, Editor

Preparedness Work Lags

Apparently the good work done by NECA at the War and Navy Departments in Washington is bringing good results. Word comes of a few contracts placed by government agencies in which the general contractor was enjoined to employ the service of specialized subcontractors on electrical work.

Meanwhile, of course, few contracts are being placed. Cantonments to house 360,000 National Guards, it is said, will be built immediately. But despite the constant report of orders "cleared" by the Defense Commission, almost no contracts have so far been placed and almost no war production or preparedness production is under way. Manufacturers are simply waiting to find out how they are to be permitted to amortize the new buildings they are compelled to construct to handle war orders and what taxes they are going to have to pay. Without this information costs cannot be computed and everything waits.

If Congress settles this issue, an enormous volume of production orders will flow out to industry. If for political reasons, Congress does not act until after Election the whole program seems to be destined to wait until November or whenever the situation is cleaned up. The electrical contractor, therefore, must not think that because no preparedness production has actually started in his town that it is to mean nothing to him. When Congress acts, the work will start and manufacturers will become more critically aware of their need for better lighting, air conditioning control and the general electrical modernization of their plants which will entail rewiring.

As a matter of fact, however, a contractor need not wait for that. Those manufacturing plants in every city that are to receive war orders, know it now. Also you can show them right now what can be done to improve their electrical efficiency. The preliminaries may all be cleared up while they are waiting for the red tape to break and the work to start.

Important Inspector Meetings

In this year of the 1940 Code, the five Section meetings of the International Association of Electrical Inspectors are unusually important. The many important revisions bring up problems of interpretation and enforcement.

Electrical contractors, too, have to interpret the code, and it is going to take plenty of team work between contractors and inspectors to get it underway. A liberal representation of electrical contractors at the Section meetings will get us all off to a running start.

Bushes or Outlets?

Wiring costs too much, especially adequate wiring, so we must work like hell to cut the price down. So help us, if we don't, folks will go back to kerosene. There is no market for luxuries these days.

For instance, Al Kessler, who heads up adequate wiring promotion in Minnesota, reports the case of one home builder who stretched the budget to the breaking point to give the electrical contractor $30 more for additional outlets. Then along comes the nursery man and takes $500 away from him for a three year planting program.

Against stark necessities like hollyhocks and petunias, adequate wiring has a tough up-hill fight, if we have any consideration for our customer's pocketbook. Adequate wiring gives only safety, comfort, economy, convenience, facilities for labor saving household tools, coolness in summer, heat in winter and twice its cost in resale value of the house.

Are these paltry virtues worth talking about? Can't we compete with a forsythia bush?

The Convention

It is not too soon to do a bit of planning for the coming convention of the National Electrical Contractors Association. As you know, the meeting will be held at the George Washington Hotel, Jacksonville, Oct. 21–23. It brings the usual valuable opportunity to give a week for the study of the broader problems of the contracting industry and strengthen your own ideas of management, operation and installation technique with those of other men in the same business.

This convention offers more—it will carry you to the Southland and show you contracting under conditions that in many ways are different from those encountered in your home town. And much of this experience can be made valuable to you. In addition to the trip, therefore, and the enjoyment of the convention as a holiday, is this certain reward awaiting any man who wants to make the trip pay dividends.

The difference between going and not going is largely a matter of saying to yourself that you will go. Don't put off the decision. Make your reservations now. You owe it to your business to go.

Your Aliens

The Alien Registration Act of 1940 calls for the registration and fingerprinting of all aliens above 14 years of age between August 27 and December 26, this year. It should be the responsibility of every contractor to see that those aliens in his employ present themselves for registration.

There is no intent under this Act to discriminate against aliens. We desire to preserve their friendship and loyalty as employees and as future citizens. But in these times the measure

is a sound one and in the interest both of the alien and the citizen.

We urge that every electrical contractor, every motor shop man and every chief electrician find out immediately what aliens he has in his employ and see that they promptly conform with this law. As union labor is provided for any job during this registration period, a check should be made to see that aliens have registered or understand the need for it and intend to. This is not only a patriotic duty, but a measure for your own defense. For the purpose is to root out unfriendly aliens, who behind your back may make trouble in war plants and you may be seriously involved.

Quality vs. Trouble

The chief electrician of a large county hospital works five days a week. But on his days and nights off, he is on call in case of emergency.

Under these circumstances failures of equipment make him a lot of trouble. He, therefore, has had a constant incentive to protect himself against breakdowns and unconsciously has been launched on a program for the improvement of equipment that goes into the system for which he is responsible. He has found that by buying top quality products, best wiring materials, equipment and electrical machinery, he has materially reduced the trouble caused and the interference with his own leisure.

And here again the policy has been proven. It pays to buy good stuff.

It Can Be Done

This country is so vast that any campaign of selling that proposes to do something to every home or every factory or every store just staggers the imagination. It seems futile to even start it. But it is all right to contemplate and consider what might happen, we'll say, if every electrical contractor in the country should make the effort to install one additional outlet in every home that he has wired. That would mean twenty odd million outlets and they could all be put in on one sunny afternoon.

But let's make it easier. Let's set the goal as two outlets in half the houses or five additional outlets in 20 per cent of the homes of America. No one will doubt that 20 per cent of the homes need and can be sold this small bill of goods. Yet here waits maybe $50,000,000 worth of business that can be closed on any weekday if the contractors want to step out and do a bit of selling.

Back Talk

Bank Lighting

To the Editor—"The important field of fluorescent lighting for banks has been overlooked up to this time. The bookkeepers, clerks, cashiers and tellers supplement the general lighting with various make-shifts in the form of desk lights, inadequate lights over the tellers' windows and bookkeepers' machines, etc. Now since science has made the fluorescent light fixtures, why doesn't some smart manufacturer design fixtures especially for over tellers' windows that will give adequate foot-candle power. For these people often have very close work at long periods of time. I am trying to help our bankers in this problem and have tried in vain to find anything suitable for this work."

R. G. Null, City Inspector
Ruston, La.

It is our impression that there are several manufacturers who have equipment specially designed for this service. We suggest that you drop a line to the lighting equipment manufacturers whose advertisements appear in this issue and tell them what you are looking for. We believe you will find the answer. Also write to the Illuminating Engineering Society, 39 West 39th Street, New York, and get their advice.

He Sure Does

To the Editor—"May *Electrical Contracting* was interesting—but wrong, and I think page two of my letter will prove my contention. THIS contractor did SELL, as well as engineer and install the tennis court lighting illustrated, and I'm proud to have been associated with this project. I believe there is nothing else like it in the world."

Raymond W. Corwin
Benjamin Electric Mfg. Co., Chicago.

(Enclosure—data on recent installation done by Utilities Engineering Co., Philadelphia.)

Thanks, Mr. Corwin. You win. This job of Howard Miller's was sold. And there are other contractors who do a selling job. In the editorial "Bare Handed" we were speaking of contractors in general and we said —"They don't like to sell." We were right but so are you in this case—and there are many others, thank God!

The Mail Order Houses

A few months ago we ran an article "The Truth About Sears and Ward." It reviewed the charges of unfair competition often made against these two large mail order houses. It reported the attitude of the management in Chicago toward the electrical contractor, and the policy that has been set up at headquarters. We have these four letters taking exception to our presentation of the case—

1. To the Editor—"We appreciate the encouragement you give on this problem, but I am enclosing evidence which in my opinion, is contrary to their statement and policy."

U. C. Nolte
U. C. Nolte Company
Belmond, Iowa.

Mr. Nolte encloses a local ad by Ward reading—"We specialize in wiring home and farm buildings. Estimates gladly given."

2. To the Editor—"I hope the Chicago offices are right. But it is hard to believe as I worked with a man who ran a crew of ten to fifteen men wiring farms. I was the only journeyman. The contracts were sold for Sears and signed by their agent. I didn't work long because I refused to install the cheapest materials not approved and tell Mr. Farmer they were the best. I am enclosing an ad in tonight's paper that might interest you."

C. R. Yoho
Lincoln, Nebraska.

Mr. Yoho enclosed a local classified ad reading—"Wanted—experienced REA contractor to increase his earnings by selling wiring jobs for us—Montgomery Ward Co."

3. To the Editor—"Regarding the Sears Ward article, it evades the true issue. The fact that anyone can purchase material at same price as contractor shakes the manufacturer - wholesaler - contractor - consumer policy by eliminating the contractor. We do not do the type of work which they are in a position to affect, but article didn't hit home."

Leo W. Witz
Continental Electrical Construction Co.
Chicago, Ill.

4. To the Editor—"I think your article is certainly a wonderful piece of propaganda for Sears and Ward. You state that neither one of these mail order houses sell merchandise that is not approved and again you are wrong because they sell plenty of unapproved appliances. In your last paragraph you state they are not trying to run the contractor out of business and again you are wrong. How can Montgomery Ward sell No. 14 wire at $4.90 a thousand and this same wire costs the jobber $6.00 less 12½ per cent?

"If you are going to try to improve the industry and save the electrical field for the electrical contractor, why don't you show you are for the contractor and reprimand the manufacturers who are selling electric wiring materials to the mail order houses cheaper than the electrical jobber can purchase it. That is the reason why contractors go to mail order houses to buy.

"I do not think you have the nerve to reprimand manufacturers instead of telling the electrical trade they are at fault and unless they get on their knees to Sears and Ward they are going into the contracting business which I know they are in today."

H. Weinstein
Portland, Oregon

To these gentlemen we say—the article frankly stated its purpose, to report on the attitude of the management in Chicago of both these mail order houses, and to give our impressions as to their present policy and their sincerity. We believe it is a true reflection of present policy. We suggest that wherever the local policy does not conform with this national policy, that complaints should be made by local contractors to headquarters.

Where there are 1100 local managers some are bound to let their zeal for business carry them beyond their authority. We still feel that the article has served a useful purpose. If you still feel that your local branch houses are not conducting themselves in accordance with the policies of the management, you show them the article and ask why not. If you don't get satisfaction, put it up to Chicago.

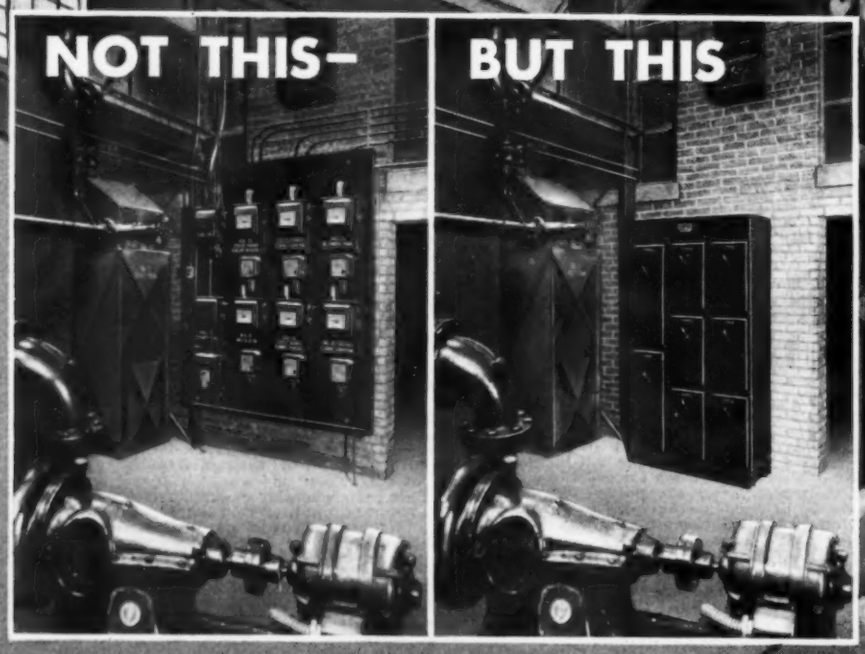
National Defense

Killark Electric Manufacturing Company took our July opening editorial on "National Defense—Our Responsibility" and sent it out to all their distributors and customers. They added—

"This article tersely re-emphasizes points I've brought up in recent letters to you—that defense work is our responsibility, and that the huge defense program offers us the greatest business opportunity of all time.

"Read the attached editorial. Read it often. Then make sure you and your salesmen are getting your share of this new business, and doing all in your power to help Uncle Sam in his hour of need."

NEWS..AN IMPORTA



NT ANNOUNCEMENT

to All Users of Motor Control

CUTLER-HAMMER LEADS AGAIN . . . TO MARK ANOTHER MILESTONE OF ENGINEERING PROGRESS **UNITROL**

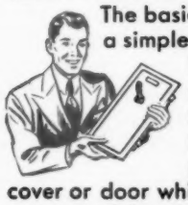
TRADE MARK

UNITROL
Sectionalized Motor Control

Unitrol is a new idea in Motor Control. It is a new unit type of standardized Motor Control construction which permits all needed types of control devices to be easily organized into a complete enclosed sectionalized Motor Control Center . . . making it just as big or just as small as your present needs require. It is easily, quickly and economically built up, without special engineering, containing just the individual controllers, disconnect switches, and accessories you specify.

Unitrol comes to you complete . . . either with all wiring, busses, supports, terminals and interconnections already made . . . or with provisions for wiring it "on the job". It may be changed, extended, or contracted later on, just as easily and economically as it was first built up. It saves space, time, trouble, worry, and inconvenience up and down the line; and its installed cost is less than the cost of any "home-made" substitute.

1st . . . The Unitrol Unit



The basic element of Unitrol is a simple unit mounting-frame into which any standard control device may be bolted. This unit frame has integral with it a hinged cover or door which may be blank, or arranged for either dead-front manual or push-button operation of the device enclosed.

2nd . . . The Unitrol Section

The Unitrol Section is a steel enclosure which houses and supports a group of Unitrol Units. It is constructed of standardized interchangeable members to form the sides, top and back . . . with unique provisions for bus supports, wiring troughs, conduit or duct entrances, etc.

3rd . . . The Unitrol Control Center

A Unitrol Control Center consists of a grouping of Unitrol Sections fabricated into a complete sectionalized assembly and delivered ready for installation and use.

Unitrol...Fits control to the job

Unitrol permits your control installation to be shaped at will . . . in a straight line, an L-shape, or a U-shape in which case it literally forms its own control room. In some instances, controls may be mounted back to back in the same section . . . resulting in a space economy hitherto undreamed of! And the individual control unit with its door frame forms a brand new time, cost, and trouble-saving "built-in" control for builders of motorized machines.

UNITROL
Solves many problems

DESIRABLE. Unitrol brings to your control all the simplicity and flexibility of the modern filing cabinet idea. It offers standardized uniformity, appearance and economy. It is *the* control of tomorrow . . . ready for *today!*

ADAPTABLE. Unitrol is a boon to builders. Its *known* dimensions and predictable costs permit intelligent planning, with no fuss or worry about placement of conduits in concrete. Unitrol fits right into the job, and can be revamped, changed or extended later with ease.

LOW COST. With Unitrol, there is no supporting structure to fabricate; no floor or wall preparation; no special engineering. Unitrol saves space and building alterations! One recent Unitrol installation put 132 motor starters into the same space which could not accommodate more than 50 conventional starters of the same rating.

Write for this book

A new book..."Unitrol...the next step forward in Motor Control," tells the whole important story. Gives full description of Unitrol, its many uses and amazing advantages, its construction and specifications. Profusely illustrated. Sent free by request on your business letterhead. Write for *your* copy today. CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers,* 1306 St. Paul Avenue, Milwaukee, Wisconsin.

CUTLER-HAMMER
UNITROL
C-H

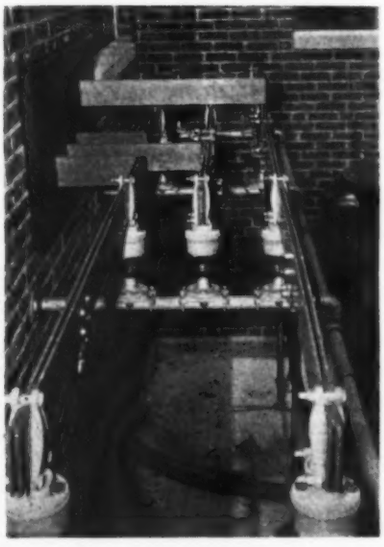
Copr. 1940—Cutler-Hammer, Inc.

THE MODERN SECTIONALIZED CONTROL CENTER

WIRING Methods

OUTDOOR SECONDARY BUS

To save much needed space and to prevent too many crossovers, the Garden Electric Co., Inc., Elizabeth, N. J., designed the outdoor bus work for this transformer mat so there would be only three rows of copper bus. The system is three phase, four-wire, 120/208-volt. Each leg of the secondary consists of two ¼ by 4-inch copper buses paralleled and mounted on insulated supports clamped to an iron pipe frame.



MINIMUM CROSSOVER of secondary buses is accomplished by this arrangement. Three phase legs take two rows of bus. Neutral with crossover is the third bus.

The illustration shows phase A (upper left hand corner) and phase B (lower left foreground) in the same horizontal and vertical planes. They are arranged so that phase C (center bus) enters the building between them and is in the same horizontal plane. The neutral bus at the extreme right is the only one that runs the full length of the mat and enters the building by crossing over the others.

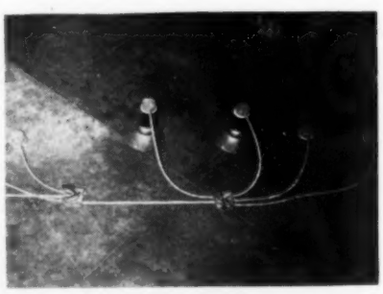
All buses enter the building through an opening in the brick wall which is covered by ebony asbestos cut to make a snug fit over the buses. The cover is divided at the phase leg buses to make mounting easy. Only the neutral bus had to be slid through the opening. The entire cover is painted with an insulating mastic cement to prevent water from entering the building along the buses.

The buses were mounted high and long flexible transformer tap leads used to permit the installation of larger transformers in the future, if necessary.

WINDOW REFLECTORS

Trouble shooting on window reflector cases was responsible for a new idea in wiring of window reflectors by Tommy Heinze, Ace Electric Company, San Diego. To overcome the burning of rubber-covered wire in flexible conduits serving window reflectors, he worked out a simple scheme as follows.

A pull box was located about every 4-ft., serving four or five reflectors each. From the pull box was run ⅜-in. flexible conduit to each individual window reflector. Into this small diameter flexible conduit was pulled two No. 18 asbestos wires attached at the other end to a regular 3-in. porcelain keyless receptacle mounted on a 3-in. box to support the reflector. Standard bx red fibre collars were used at the end of the flexible conduit and standard ⅜-in. bx connectors. In this way, the rubber covered wire is from 18-in. to 2-ft. away from the reflector. This eliminates danger of insulation burning off and of fire hazard. It also provides flexibility over the ½-in. flexible conduit used in many instances. Because of its smaller diameter it has greater ability to take a twist. The electrical inspector approved the method for field trial and it has worked out satisfactorily. His interpretation was that if the individual run from the outlet box was not over 36-inches, this arrangement could be considered a fixture and it was possible to use No. 18 asbestos wire.

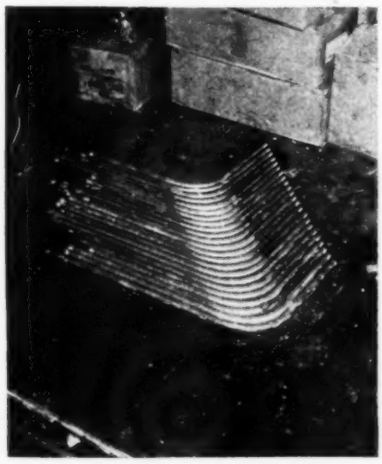


IMPROVED METHOD of wiring window reflectors uses asbestos wire in flexible conduit and eliminates fire hazard.

As far as cost is concerned, slightly higher cost of material is offset by lower labor cost.

NO WASTE

The M. G. Foster Co., Boston, Mass., electrical contractors on a large low cost housing project, uses every available piece of leftover conduit on the job.



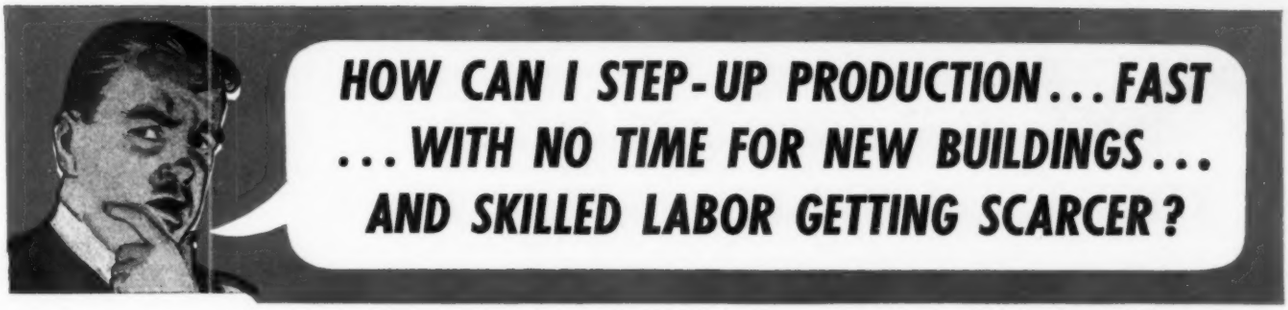
PRE-BENT ELLS made of scrap pieces of conduit reduce waste on large housing job. Straight lengths are cut to fit between the two ells, for jumpers from box to box.

Since most of the apartment circuits are run from outlet to outlet in the floor slab, the scrap lengths of conduit are bent into 90 degree sweeps with the correct riser height. Full lengths of conduit are then cut to fit between the two elbows.

Short pieces that cannot be bent are machine threaded for nipples, to be used wherever necessary. Nippling, however, is kept to a minimum.

TEMPORARY CHANGEOVER BUS

The Sterns Electric Equipment Company of Buffalo, N. Y., is doing a large



General Electric offers

AN EFFECTIVE SOLUTION TO TODAY'S EMERGENCY PRODUCTION PROBLEMS!

THE present national emergency demands that industry produce more goods . . . of better quality . . . and at greater speed than ever before.

If there's no time for new buildings, and skilled labor is difficult to get, the alternative is to get more and better production from existing equipment.

Adequate plant lighting . . . better light for faster, safer, more accurate seeing . . . offers every industrial plant in the country an effective means to meet today's emergency production demands.

Industrial lighting surveys show that most plants can go a long way toward better production schedules by bringing their lighting up to modern standards of efficiency. The fact is that higher levels of properly planned lighting have a direct bearing on increased production.

General Electric is ready to help provide better lighting immediately to increase production in your customers' plants. Not only should you consider the most effective light source to fit their particular requirements but also the electric equipment necessary to supply power to the fixture. Transformers for increased power supply, regulators to keep voltage levels up, adequate industrial wiring to provide power with minimum loss in the line—all are equally important if customers are to obtain the proper lighting for every manufacturing operation.

Read carefully the following pages describing many G-E products used in industrial lighting. Fill out the coupons which will bring you more specific information on products of interest. Better still—get in touch immediately with your nearest General Electric Sales Engineer. He stands ready to work with you for Better Light for Better Production.

GOOD LIGHTING MEANS BETTER PRODUCTION BECAUSE IT:

1—*Makes seeing easier, faster, more accurate;*

2—*Increases efficiency and reduces fatigue;*

3—*Reduces accidents;*

4—*Conserves eyesight;*

5—*Improves morale of employees because of brighter, more cheerful working conditions.*

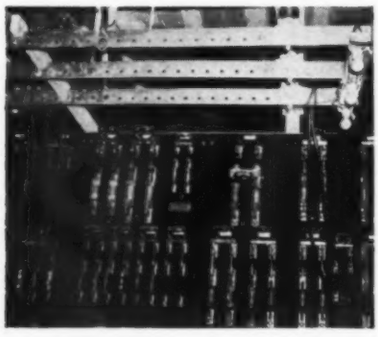
For further specific information, see each of the General Electric advertisements on the following right-hand pages.

GENERAL ELECTRIC

[FROM PAGE 24]

changeover job in one of Buffalo's large bank buildings. The entire electrical system is being changed from 25 cycle to 60 cycle operation.

One of the major problems encountered was that of providing temporary connections for the numerous circuits in the switchboard room while the new three phase, four-wire 60 cycle feeders were being installed. The work had to be done during business hours and all equipment had to be kept in operation. Immediately after the new 60 cycle equipment was installed, the circuit feeding it was connected to the new service.



TEMPORARY BUS with individual circuit jumpers solved the problem of maintaining service continuity during a system changeover in a large bank building.

To accomplish this a temporary 60 cycle service was installed to feed three copper buses mounted directly in front and above the present switchboard, and supported by notched 2 by 4's and bus supports. Each bus has a large number of holes drilled in it on 3-inch centers to which the individual circuit jumpers are bolted. Even though the new system is 250-volts, the buses were mounted 12 inches apart to allow ample room for the mechanic to mount the jumpers without coming in contact with the other buses. Three red lamps were connected to the end of the buses nearest the door of the room to warn anyone entering that the buses were "hot".

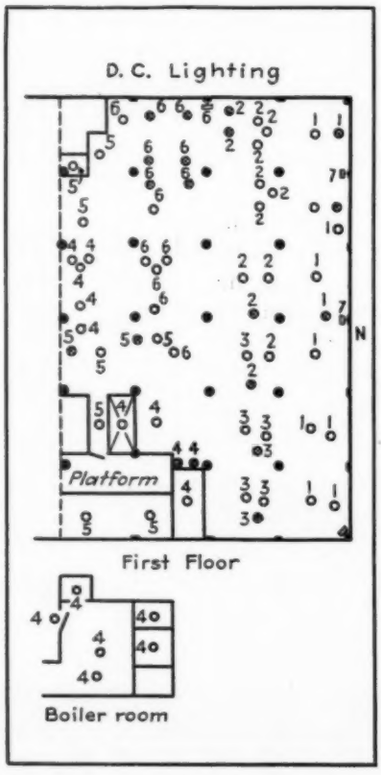
The jumpers were mounted from the temporary 60 cycle bus to the base of the knife switch on the board. The hinge bolts on the knife switch were then tightened thus locking the switch in the open position. The original circuit from the board to the motor still had the protection of the circuit fuse. The circuits were changed one by one until the entire panel was on the 60 cycle line. Then a jumper from the buses to this section of the switchboard was installed putting the entire panel on the 60 cycle lines and the individual circuit jumpers were removed. This required only a few minutes for each circuit changeover and satisfactory continuity of operation was maintained. At the same time work continued with the installation of a new 3000 ampere breaker in an adjoining room and the installation of an underground feeder to the present switchboard. The work was so arranged that with the service connection to the breaker finished, it meant only a few connections from the new feeder to the board to complete the permanent service. This temporary bus set-up cost the contractor about $60, but it more than paid for itself in the resultant saving of overtime labor and the continuity of service it afforded the customer.

PANELBOARD DIRECTORY

Instead of the usual typewritten or printed list, a reduced scale, simplified plan of the area served by a panelboard is used as a directory on commercial wiring installations made by the Hyre Electric Company of Chicago.

The small layout plan, reduced to 7¾ by 3¾ in., shows columns, partition outlines and outlets. Each outlet symbol is numbered according to the circuit which feeds it.

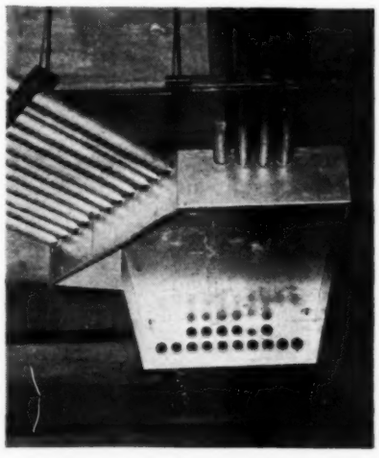
The plans are blueprinted and mounted under glass inside of the panelboard door in the usual directory holder.



LAYOUT PLAN in reduced scale makes a convenient, easily followed panelboard directory.

THREE-WAY PULL BOX

Three-way distribution of a large number of 3-inch conduits in the electrical system of the Buffalo Memorial Auditorium in Buffalo, N. Y., is accomplished by the use of a specially fabricated junction box mounted to the steel beams of the basement ceiling.



THREE-WAY INTERSECTION of 29 3-inch and three 2-inch conduits is made possible through the use of this large, specially designed pull box, which provides plenty of working area for the cable pulling job.

McCarthy Bros. and Ford, the electrical contractors on the job, designed the box large enough so there would be plenty of working area for pulling in the numerous cables. The box is constructed of No. 10 gauge steel and measures 7-ft. 1-in. in length; 4-ft. 7-in. in width with the offset measuring 3-ft. 11-in. in width. The box is 15-in. deep. Fifteen 3-inch and one 2-inch conduits enter from the large pull box outside the switchboard room. Four 3-inch conduits continue straight through with a spare knockout for a 2-inch conduit. Ten 3-inch and one 2-inch conduits branch off at the offset to feed another part of the auditorium. A large steel screw cover encloses the box.

The box is mounted flush against the steel beams by mounting bolts anchored in the concrete ceiling slab. The conduits are supported by single and double deck trapeze hangers also anchored in the concrete slab.

G-E MAKES ALL KINDS OF LAMPS BUT EACH LIGHTING JOB MUST BE "TAILOR-MADE"

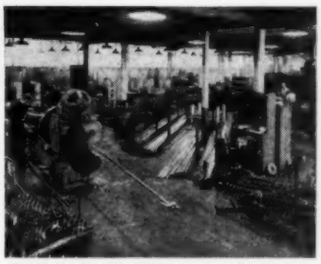
REGARDLESS of the kind of business your customers operate, General Electric makes lamps to fit their needs. Because G. E. makes all types of lamps, you can make an unbiased lighting recommendation.

Not only in industrial plants but in offices, too, work goes faster and more efficiently when the lighting is right to meet seeing needs. Sometimes, because of the plant layout and the particular kind of work done, incandescent lighting with G-E MAZDA C (filament) lamps will produce light most efficiently.

In other places fluorescent lighting with G-E MAZDA F (fluorescent) lamps will provide the higher lighting levels required. So that your customers will know where and *where not* to use it for best results, G. E. urges them to consult a qualified local authority . . . *to show them* how to get 50 footcandles or more . . . either with G-E MAZDA C lamps, or with G-E MAZDA F lamps, or other types of G-E MAZDA lamps or a combination of them. For specific information, write to General Electric Company, Dept. 166-EC-I, Nela Park, Cleveland, Ohio.

INCANDESCENT LIGHTING SPEEDS PRODUCTION IN THESE PLANTS

A CHICAGO RADIO company found production up, rejects down, after light-conditioning with regular G-E MAZDA C (filament) lamps. Employees have 55 footcandles of light on assembly work.



THIS CLEVELAND manufacturing plant appreciated that good light is indispensable in the manufacture of a quality product and used 300 watt G-E MAZDA C lamps in RLM dome reflectors to get it.

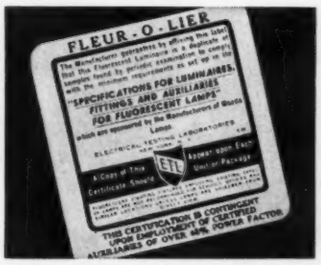
FOR CONCENTRATED localized light where it's needed in shops and factories, the new G-E MAZDA Projector lamp helps speed production. Lens, reflector, and filament are combined in one unit.

FACTORY FLOODLIGHTING is an essential requirement in many places today . . . not only to facilitate night work but also as an added safety precaution. G. E. makes many types of flood lamps.

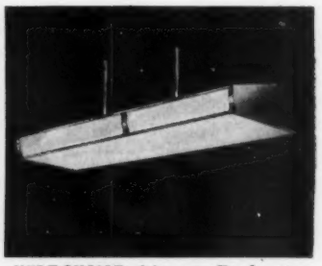
FLUORESCENT LIGHTING IS BETTER SUITED TO THESE JOBS

INSPECTION is made easier and eyestrain lessened by G-E Fluorescent lighting installations such as this one over inspection tables in a tin-plate plant. This better lighting has speeded production and reduced spoilage.

FINE WORK, as in textile mills like this, needs well diffused light to soften shadows and reduce glare. G-E MAZDA F lamps may provide 100 footcandles or more without discomfort from heat.



LOOK FOR THIS TAG—certifying that fixture meets specifications set up by MAZDA lamp manufacturers. Fleur-O-Liers must be equipped with auxiliaries (ballast and starters) certified by E.T.L.



WIDE CHOICE of fixtures. For best results, G-E MAZDA F lamps are recommended for use only with equipment providing good power factor . . . fixtures such as Fleur-O-Liers or RLM industrial units.

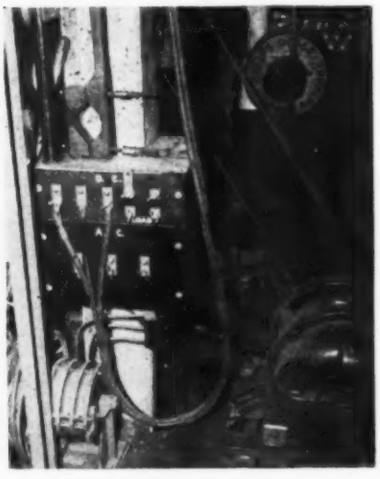
GENERAL ELECTRIC

BETTER LIGHT MEANS BETTER PRODUCTION

Motor Shops

REMOTE TERMINAL BOARD

The motor shop of the L & P Electric Co, Brooklyn, N. Y., has a large switch board from which they can get current of various voltages, phases and



***REMOTE TERMINAL** board with detachable leads, fed and controlled from a main test board facilitates equipment testing in this motor shop.*

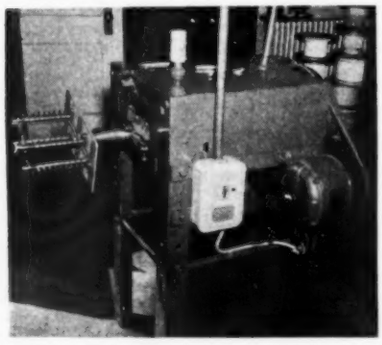
frequencies. There are so many switches and controls on the face of the board that mounting test leads was a problem. So they just built a remote terminal board and mounted it on one of the columns near the switch board.

This remote terminal consists of an L shaped steel box with a split ebony asbestos face, the top of which is for d.c. and the bottom for a.c. Direct current voltages available are 110- and 220-volts. Alternating current voltages range from 0 to 600-volts, single-, two- or three-phase. Voltage and phase changes are controlled by switches on the main switchboard. Wing-nut terminals on the remote board permit the easy attachment of long test leads which can reach to the equipment to be tested. One set of leads are wound on a reel at the foot of the board so they are always out of the way when not in use.

EIGHT SPEEDS AHEAD

This winding machine built by Max Hamann of Electric Engineering and Service, Inc., Westfield, Mass., provides eight speeds forward from 20 r.p.m. to 350 r.p.m. and four speeds in reverse for winding operations.

The machine mechanism consists of a Packard and a Dodge transmission connected back to back. The two gear shift handles permit a choice of speed. This mechanism is V to flat belt driven by a 1 h.p., 1800 r.p.m., 3-phase, 220-volt constant speed motor through a single plate friction clutch. An external brake attached to a foot pedal permits foot control of the machine. A counter is mounted on the winding head end of the shaft to indicate the number of turns wound on to the coil form. The reverse feature permits unwinding the coils if necessary.



***MULTI-SPEED** coil winding machine employs a double transmission to provide eight speeds forward and four in reverse.*

The flexibility of the machine permits winding all types of coils and has elicited much comment from the customers who have seen it.

BAKE OVEN

A lot of good judgment and experience went into the design of a new bake oven recently installed in its shop by the California Electric Works of San Diego, Calif.

Because the overhead space under an outdoor canopy under which the oven was to be located was limited, miniature working models of the oven and especially of the door mechanism were made first. Previously worked out in

***UNIQUE BAKE OVEN** features automatic heat control, fire protective system and swinging door.*

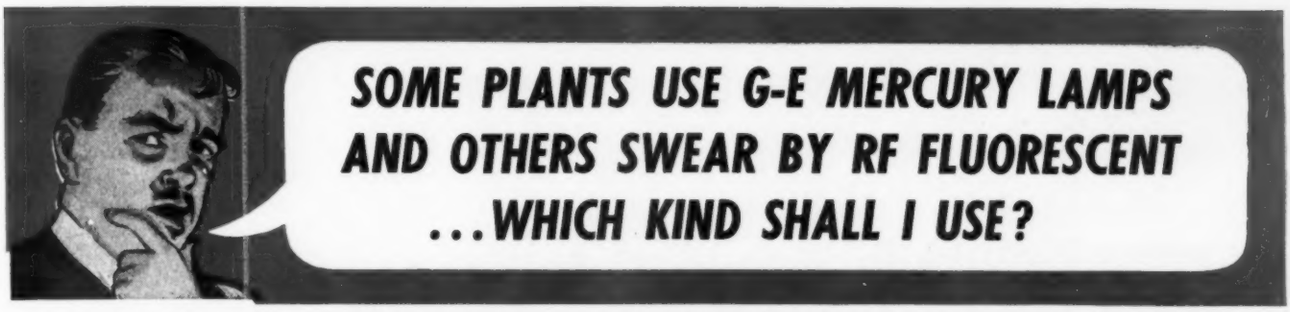
detail, it was built in sections and assembled in place.

The oven is 7-ft. deep, 8-ft. wide and 7½-ft. high. It is made of separate sections of heavy corrugated iron with a 4-in. rock wool insulation between the plates. A separate section was made for each side, the back, the top and door. The concrete floor was equipped with rails on which a movable platform can be rolled in and out of the oven on roller-bearing wheels. Atop this steel plate platform is a pipe rack made with cross-hatch bars to permit the placing of a number of small motor parts for baking.

A safety panel has been located in one of the side walls so that it will give in case of internal explosion and allow the escape of gasses harmlessly overhead.

Hanging and hinging of the door was especially well-designed. The door-supporting mechanism is independent of the side walls, resting on its own channel iron support anchored to the concrete floor and braced against the back wall. By adjustments to the bolt against the back wall, the door can be tightened against the jam if necessary.

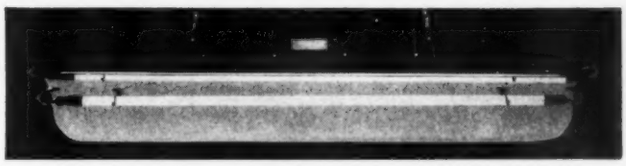
The heavy door is counterbalanced and swings on two cantilever arms at each side supported on the angle iron framework. The hinge bearing is itself a pipe which runs through the door from one edge to the other, held in



GENERAL ELECTRIC MAKES BOTH KINDS AND EACH IS WELL SUITED TO SPECIFIC JOBS

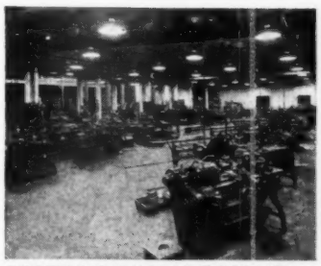
IN general, G-E MAZDA H (mercury) lamps are best suited for lighting high bay areas. The 400 watt size is shown to the left. These lamps have high efficiency, long life, and ruggedness. Mercury lighting is most economical when it is tailored to the individual plant needs — properly used and distributed, using approved auxiliary equipment. It may be used advantageously either alone or in combination with filament lamps.

RF 85 watt (Cooper Hewitt) fluorescent lamps, are well suited for lighting low and medium bays. Have high light output, long life, and low operating cost. Available in two types—a

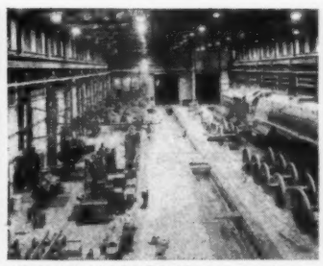


Blue-White and an industrial White, in one and two lamp fixtures. The color of the new industrial White lamp more closely resembles natural daylight than does the Blue-White lamp and will prove practical for many industrial applications where color discrimination is important. For details, write General Electric Company, Dept. 166-EC-I, Nela Park, Cleveland, O.

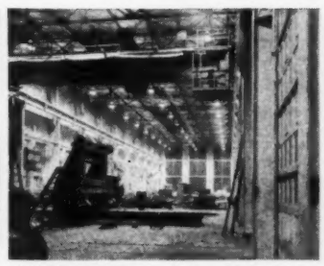
MERCURY LAMPS ARE GOOD FOR LIGHTING HIGH BAY AREAS



MODERN LIGHTING with G-E MAZDA H (mercury) lamps provides "better than daylight" illumination in this factory. This lighting was engineered to the job, shadow, glare, and light quantity are controlled.



IN THIS LOCOMOTIVE repair shop, 400 watt mercury lamps are used for high bay lighting. Good lighting like this aids accuracy by relieving nervous tension of eyestrain. It also helps reduce accidents.



IN THIS METAL working plant a mercury lamp installation provides 30 footcandles on the working plane although the lamps are mounted at a 35-foot height. Seeing is easier and more productive.

IN THIS PLANT production was speeded when mercury lamps were installed at a 14-foot height to provide 75 footcandles on the working plane. Better light like this is a big factor in obtaining better production.

RF (COOPER HEWITT) FLUORESCENT LAMPS FOR LOW BAYS

IN THE AUTOMOTIVE industry, RF Fluorescent lamp installations find many applications such as lighting this paint spray booth. Heat is less bothersome because more of the electric energy is converted into light.

RF FLUORESCENT lamps provide excellent illumination in this southern hosiery mill. Under this well-diffused light, threads are so clearly defined as to appear magnified. Inspection is simpler and production up.

NOTICE HOW CLEARLY detail is revealed in the light of this RF Fluorescent installation in an Illinois factory. Because of the long-tube light source, shadows are controlled. There is less eyestrain, less fatigue.

IN THIS 5-ACRE windowless plant, all daylight has been excluded. The plant is lighted entirely with RF Fluorescent lamps. The installation provides a uniform level of light throughout the plant.

GENERAL ELECTRIC

BETTER LIGHT MEANS BETTER PRODUCTION

Motor Shops

[FROM PAGE 28]

place against the door by means of flanges. A steel rod through the pipe with washers at each end keeps the hinge in place.

Heating is automatically controlled. An 85,000 Btu gas heater, well insulated and with a stainless steel fire box, is located just outside the oven. Hot air is forced into the oven by means of a blower. The heater is on an electric clock and temperature control which operates the gas supply through a magnetic valve. The furnace is tripped on by hand but thermostats cut off the gas at the pre-set temperature, the blower running continuously recirculating the air. The valve is set for a 200-Btu maintaining flame with the booster on the thermostat to maintain temperature at 250 deg. This arrangement does away with the usual full-on and full-off with the consequent override of temperature one way or the other. As a safety device, the thermostat is on the heater itself and is set at the limit temperature. It kicks off the latched-in relay which closes the magnetic valve. Pilot lights give visual indication of the operation at all times. The time clock capacity is for a 24-hr. setting although the ordinary settings are of 8 or 9 hr. baking time.

Inside the oven are a number of "meat hooks" along the sides upon which small armatures can be hung. The dipping tank is outside near the entrance to the oven along an overhead crane rail which services both.

Oven was designed by Frank Sloane, shop superintendent, and his associates.

INDIVIDUAL TEST BOARDS

Each man in the motor repair department of the L & P Electric Co., Brooklyn, N. Y., has his own work bench complete with drawer, locker, bench light and test board.

Each test board is separately fused at the bench and contains sockets for test lamps and load resistances. Voltages available on the board are 110–220-volts d.c. and 110–220-volts single- or three-phase a.c.

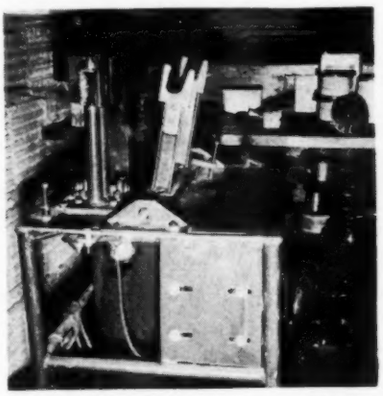
Each man has his own set of tools in the bench locker. Thus a man can work independently and no time is lost looking for tools or waiting to test the equipment he has repaired. The rounded end of the bench and ample room on each side enables the mechanic to work from either of the three sides.

***INDIVIDUAL BENCHES** complete with test board and locker facilities permits a man to keep his tools together and work independently, without interference from his neighboring mechanics.*

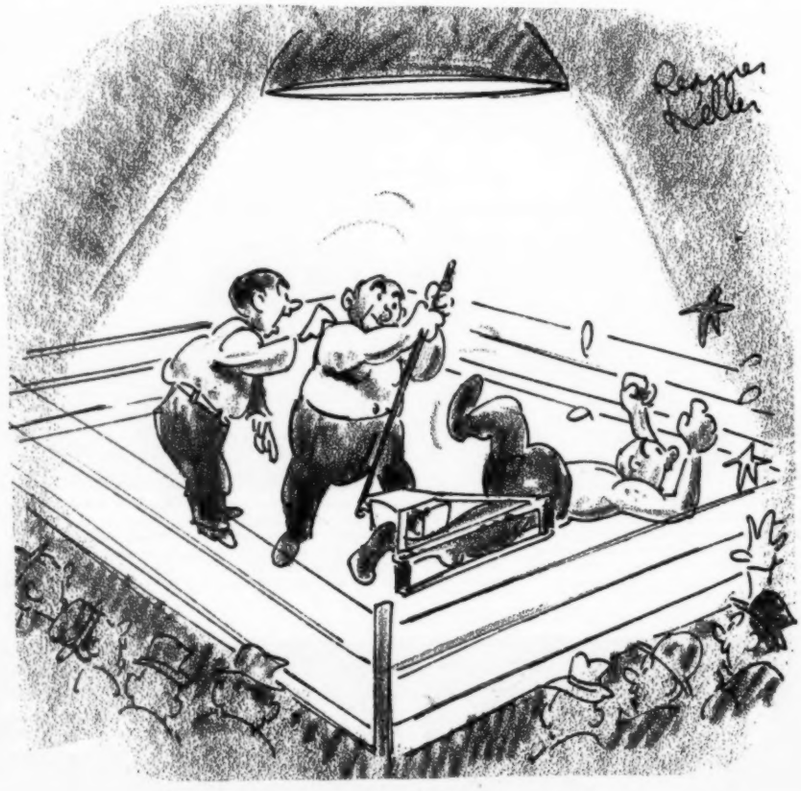
STRIPPING MACHINE

Efficiency in handling rewiring of small motors depends upon having equipment to take care of a multitude of routine operations and save expensive time. California Electric Works, San Diego, makes use of many such devices, among which is a motor-driven insulation stripping machine especially designed for small motor rotors.

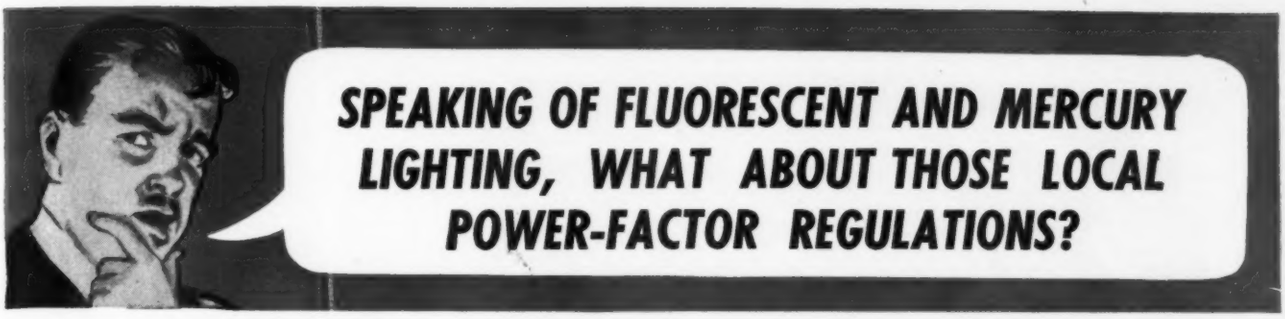
Two vertical shafts are belt-driven in opposite directions from a 1700-rpm motor to attain a speed of about 1800-rpm. On the ends of the shaft are wire brushes protected by a metal shield. Facing an aperture between the two brushes are two adjustable rods to handle the small motor armatures with stops to regulate the depth of the stripping. A vacuum cleaner has been built into the apparatus to draw off the cotton threads and dust. Leads from all of the coils on an armature can be stripped clean in just a few seconds preparatory to soldering.



***MOTOR-DRIVEN** insulation stripping machine designed for small motor rotors.*



"Sorry, but conduit benders are out!"



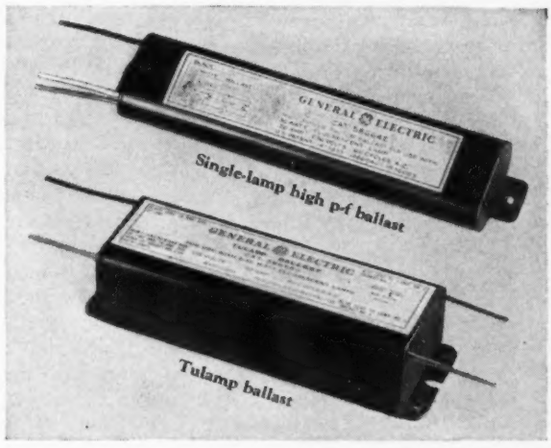
IF YOUR LAMPS ARE EQUIPPED WITH G-E BALLASTS, POWER-FACTOR IS NO PROBLEM

FLUORESCENT installations comply with all local regulations concerning power-factor when fixtures are equipped with G-E Tulamp or single-lamp high-power-factor ballasts.

These ballasts provide an over-all power-factor of 90 per cent or better, and offer important economies:

1. More lamps can be supplied from existing wiring, because the current drawn by each lamp is greatly reduced.
2. If new circuits are being installed, you can use smaller wire and still provide a margin of capacity for future additional lighting.
3. Losses are lower and voltage regulation is better in feeders and branch circuits.

The benefits of high power-factor cost little. For example, with G-E Tulamp ballasts, high power-factor adds only 2 to 3 per cent to the cost of fixtures for 30- and 40-watt lamps.



Use G-E Fluorescent Lampholders too
Be sure the fixtures you buy are equipped with G-E fluorescent lampholders and replaceable starters. They have been designed for use with G-E fluorescent lamps and ballast equipment.

EXTRA SAVINGS WITH G-E TULAMP TRANSFORMERS FOR MERCURY LIGHTING

G-E Tulamp transformers for MAZDA H (mercury) lamps offer all the advantages of high-power-factor fluorescent ballasts—plus extra savings in installation cost. By using one transformer to supply two outlets, wiring is simplified and installation time and costs are reduced.

The use of G-E Tulamp transformers (available for the 400-watt MAZDA H lamp) adds only about 3½ per cent to the over-all cost of transformers, lamps, and fixtures. Single-lamp high-power-factor transformers are available for both the 400-watt and 250-watt lamps.

Ask the nearest G-E distributor or G-E office for complete information—Bulletin GEA-3293, "Ballasts for Fluorescent MAZDA Lamps," and Bulletin GED-855, "Transformers for MAZDA H Lamps." General Electric Co., Schenectady, N. Y.

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GENERAL ELECTRIC

BETTER LIGHT MEANS BETTER PRODUCTION

Estimating

HANDY VOLTAGE LOSS CHART

For estimators who frequently have to prepare layouts involving accurate calculation of the probable voltage loss on each circuit, the Chicago Electrical Contractors Association has prepared a voltage drop chart. This chart simplifies the approximation of resistance drop characteristics in ordinary layout work.

The vertical coordinate of the chart is plotted in load watts and amperes while the horizontal coordinate is plotted in single distance (from supply to outlet) in feet. The upper one-third of the chart is devoted to 120 volt circuit calculations while the lower two-thirds covers the 240 volt circuits.

Calculations for this chart are based on the following formula:

$$\text{Volts Lost} = \frac{\text{Distance} \times 2 \times 10.7 \times \text{amperes}}{\text{Circular Mills}}$$

A given point plotted on the chart proper is indicated by a circle within which is shown two numbers. The upper numeral indicates the volts drop and the lower numeral designates the size of wire that gives this drop at the amperes and distance indicated by the coordinates which intersect to determine the point marked by this circle.

BUS DISTRIBUTION INSTALLATION

A busduct system using Bulldog three-phase, four-wire Bustribution duct is used for power distribution in a manufacturing plant recently constructed in New Jersey.

The layout consists of a main run of 1000-ampere duct with 750-ampere and 250-ampere branches covering the manufacturing area. Wherever duct sizes are reduced, fusible disconnecting adapters are installed. Heavy conduit and wire circuits feed the main duct run, which is parallel to the building length and is mounted 14 feet above the floor level, in the center of a high bay monitor.

The 1000-ampere duct has a 750-ampere extension at one end and a 250-ampere extension at the other end. At the junctions of these extensions, 750-ampere subfeeder ducts are tapped on to the same side of the main run and extend parallel to the building width. Each has a 250-ampere duct extension. From both sides of these subfeeders 250-ampere branch ducts run parallel to the building length and are so located as to be over the rows of production machinery.

A second high bay monitor runs parallel to the first, on the opposite side of the building. The subfeeder and branch ducts run both at right angles and parallel to this monitor.

Since all duct is mounted 14 feet above the floor, trapeze type hangers are used to support it. These are made of two ½-inch bolt rods and a 3-inch channel iron cross piece. C clamps are used on one end to mount them to the roof steel, while adjustable nuts are used on the support end to level the duct. This type of hanger is used in the low bay areas also to support the fusible adapters as well as the duct. All hangers and supports were fabricated in the field.

Extension and A type ladders and scaffolds were used in mounting the hangers and duct.

The contractor making the installation kept an accurate record of the labor required to do the job. The values submitted in this item are average values computed from the daily labor and material records. This was done because, due to the various mounting conditions and the speed the men acquired as they became more familiar with the handling of the material, the daily labor values varied somewhat.

The material installed and the average man hour data is listed below.

"HIGH PRESSURE sales methods for selling fluorescent lighting will soon ruin the market for this new light source. Each installation must be carefully engineered to give correct results and customer satisfaction," says Andrew Schroeder, Albany, N. Y., contractor. Andy is a strong advocate of hiding the tubes in coves or behind glass and louvers.

MATERIAL INSTALLED

117 feet—1000-ampere, three phase, four-wire Bustribution duct. Weight, 23 pounds per foot.

159 feet—750-ampere, three phase, four-wire Bustribution duct. Weight, 20 pounds per foot.

743 feet—250-ampere, three phase, four-wire Bustribution duct. Weight, 12 pounds per foot.

1—800-ampere twin fusible adapter. Weight, 500 pounds.

1—800-ampere single fusible adapter. Weight, 250 pounds.

2—400-ampere twin fusible adapters. Weight, 400 pounds each.

2—400-ampere single fusible adapters. Weight, 200 pounds each.

100—Trapeze type hangers to support the duct, all fabricated on the job.

12—Trapeze hangers to support the fusible adapters. Two hangers for each unit, all fabricated on the job.

LABOR REQUIRED TO INSTALL THE ABOVE MATERIAL

DELIVERY AND DISTRIBUTION—includes receiving, checking and distributing a nine ton delivery of duct.

Total time.....23.5 m. h.

FABRICATING HANGERS—includes measuring, cutting, threading, drilling and assembling 112 trapeze hangers to support the duct and fusible adapters.

Total time ..... 124 m. h.

Average time per hanger.....1.107 m. h.

MOUNTING FUSIBLE ADAPTERS—includes mounting hangers, assembling necessary rigging and hoisting and mounting the following units:

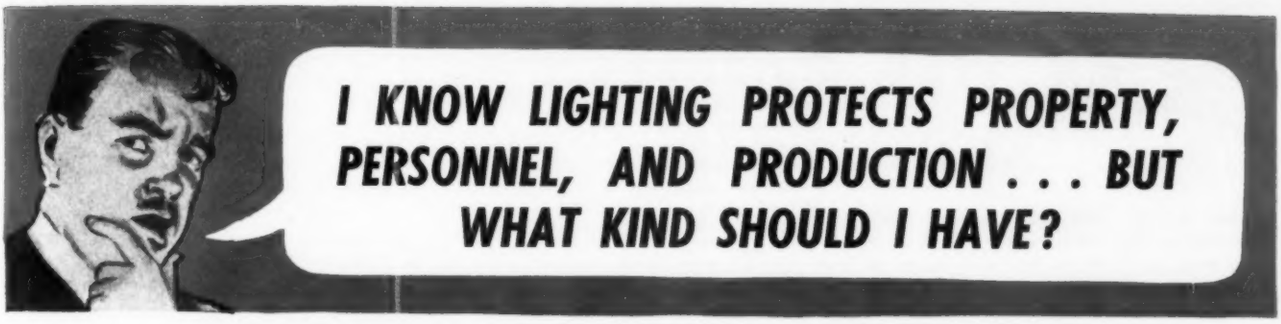
Two 400-ampere twin adapters, each weighing 400 pounds and one 800-ampere twin adapter weighing 500 pounds.

Total time ..... 36 m. h.

Average time per unit..... 12 m. h.

Average time per pound..... 0.0277 m. h.

One 800-ampere single adapter weighing 250



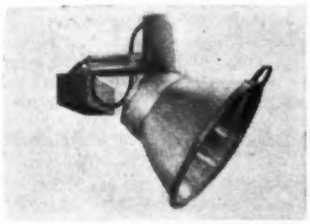
OUTDOOR LIGHTING IS NO PROBLEM— JUST SELECT FROM THE COMPLETE G-E LINE

WITH thousands of industrial plants on guard to prevent malicious destruction and production delays—adequate floodlighting is your best protection against property damage, employee injury, and the dangers of outdoor night work. Properly designed and installed, floodlights provide nighttime illumination on buildings, yards, and boundary lines, which definitely discourages trespassing and vandalism. Saboteurs may slip by guards and barriers but they can't evade well-planned protective lighting.

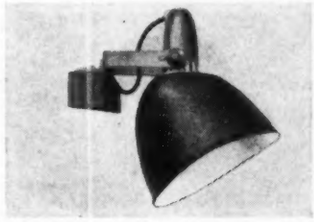
Some plants—because of layout and type of manufacturing processes—may be concentrated in a small area and need general lighting to illuminate the buildings and surrounding area. In larger plants, the protection required may be accomplished by illuminating the property line and providing lighting of low intensity in the inclosed area.

Whatever your requirements, General Electric is ready to help you safeguard property and production, with well planned floodlighting. Adequate warehouse stocks are available to answer your requirements. General Electric, Schenectady, N. Y.

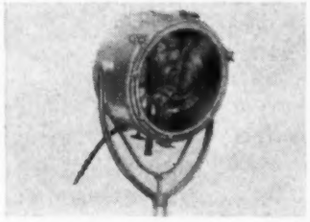
THESE FLOODLIGHTS ARE DESIGNED FOR YEAR-AFTER-YEAR NIGHTTIME PROTECTION



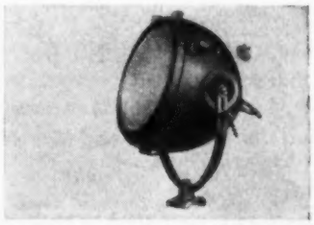
Low-priced, spun-aluminum 300- to 1500-watt enclosed floodlights have beam angles from 28 to 100 degrees. A variety of mounting arrangements makes these units suitable for area lighting.



Porcelain-enamel 300- to 1500-watt units produce a wide-angle flood of light without definite beam characteristics for lighting medium- and large-sized ground areas at close range.



Incandescent 200- to 1500-watt searchlights produce concentrated or wide horizontal beams. Available with 360-degree, horizontal pilot-house control and quick change from narrow to wide beam.



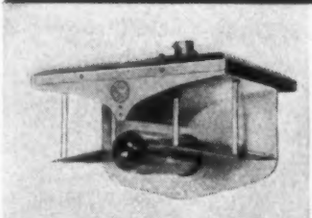
Copper-bronze floodlights have a variety of beam widths. Recommended where considerable precision of light control is wanted or where atmospheric conditions warrant rust-proof materials.

HOW TO USE LIGHT TO PROTECT YOUR PLANT

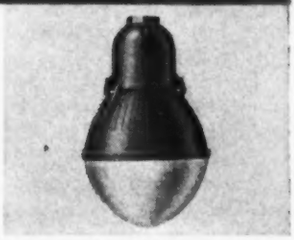
1. Throw the light into the eyes of the intruder, never on the guard.
2. Illuminate fences to silhouette intruders against a light surface.
3. Protect wiring by running it underground or in conduit where wires can not be cut.
4. Space lights close enough so that edges of beams overlap.

Get recommendations from a qualified illuminating engineer—your electric-service company has one. Or trained G-E sales engineers will give you complete lighting recommendations. Just write or call the nearest G-E office. General Electric Company, Schenectady, N. Y.

FOR LIGHTING FENCES OR LOADING PLATFORMS



Sodium luminaires are recommended for loading platforms because of their 180-degree, horizontal light distribution and high efficiency. Low lamp brilliancy prevents objectionable glare even at the low mounting heights.



Form 79 luminaires are recommended for lighting property lines because of their light-distribution pattern. Deflectors within the globe, or glass refractors, redirect a large portion of the light within the fence line.

GENERAL ELECTRIC

BETTER LIGHT MEANS BETTER PRODUCTION

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Estimating

[FROM PAGE 32]

pounds and two 400-ampere single adapters weighing 200 pounds each.

Total time ..... 21 m. h.
Average time per unit..... 7 m. h.
Average time per pound..... 0.0323 m. h.

INSTALLING THE DUCT—Includes mounting the hangers, assembling the necessary rigging, assembling, mounting and making all necessary connections to the following duct:

117 feet of 1000-ampere three phase, four-wire duct. Total weight, 2,691 pounds.

Total time ..... 58.5 m. h.
Average time per foot..... 0.5 m. h.
Average time per pound..... 0.0217 m. h.

159 feet of 750-ampere three phase, four-wire duct. Total weight, 3,180 pounds.

Total time ..... 73.6 m. h.
Average time per foot..... 0.463 m. h.
Average time per pound..... 0.0232 m. h.

743 feet of 250-ampere three phase, four-wire duct. Total weight, 8,916 pounds.

Total time ..... 163.5 m. h.
Average time per foot..... 0.22 m. h.
Average time per pound..... 0.0183 m. h.

The above figures are average values for this particular job and include supervisory labor. Since job conditions vary on each particular installation the above data should be used only as a guide for this type of system.

Data from Garden Electric Co., Inc., Elizabeth, N. J.

RADIANT HEATING LAMP BANKS

Developments in heat treating and drying by radiant energy from banks of infra-red lamps are familiar to many estimators but little experience labor data are yet generally available. Assembly unit labor costs vary considerably depending upon the size of the complete installation and the type of supporting frame.

The following data were prepared from a job involving 26 Diatherm 240-watt lamps installed in a Chicago furniture plant. The work included connecting to a 60-ampere, 2-pole cutout box, a feeder of 3 No. 8 conductors in ¾-inch electrical metallic tubing, two 2-pole, 30-ampere fused XO switches, flexible leads to the lamp banks, and two rows of 13 lamps and reflectors, each suspended from the ceiling joists. The following is the material and labor breakdown for the job:

INSTALLING FEEDER—Includes the installation of

30 feet ¾-inch E.M.T.
90 feet No. 8 stranded r.c. wire
6—terminals
3—elbows
6—pipe straps

Total time ..... 2.0 m.h.

LAMP BANK ASSEMBLY—Includes the wiring and assembly of the following:

26—reflectors and lamps
26—medium sockets
20 feet—wiring strip
60 feet—No. 14 wire
2—flexible leads each 3 ft. long
20 feet—⅛ by 1-in. perforated band iron

Total time ..... 7.0 m.h.

INSTALLING SWITCHES—Includes mounting on wood and making all connections to two 2-pole, 30-amp. fused XO switches

Total time ..... 1.0 m.h.

MISCELLANEOUS WORK—Includes necessary layout, clean up and other incidental items.

Total time ..... 1.0 m.h.

COMPLETE JOB—The total time necessary for one man to do the complete job was 11 man hours.

ASSEMBLY BREAKDOWN—Analyzing the assembly time on the lamp banks alone the work breakdown is as follows:

Assembling sockets and wiring strip 3.0 m.h.
Mounting reflectors ..... 1.0 m.h.
Installing lamps ..... 0.5 m.h.
Wiring, including leads..... 1.0 m.h.
Hanging the lamp banks..... 1.5 m.h.
Total time..... 7.0 m.h.

Thus, the slide rule gives the following net figures per unit based on 26 lamps and reflectors:

Sockets and strip assembly..... 0.12 m.h.
Reflectors ..... 0.04 m.h.
Lamps ..... 0.02 m.h.
Wiring ..... 0.04 m.h.
Total time per unit assembly..... 0.22 m.h.

On larger installations these units would probably apply up to 100 lamp jobs. Over 100 lamps the socket and strip assembly unit would probably be slightly lower. On smaller installations all of these units would be considerably increased.

The mounting method used on the above work was unusually simple. Installations requiring special frames and adjustable mounts would require much more time for hanging than shown here.

Data from James E. Rust Electric Co., Chicago, Ill.

FIGURING DUCT WORK

Electrical contractors generally sublet excavation, concrete and manhole work to other contractors. However, during the past few years more are handling their own work profitably. In estimating underground work, the estimator usually treats the non-electrical work as a separate item, checking his own figures against the quotations of sub-contractors.

Trenching costs vary with the character of the soil, the presence of water, shale or rock. The labor costs are based upon the number of cubic yards of earth to be moved and the units used are expressed in labor-hours per cubic yard. Trenching machinery for large projects is usually rented from an excavating firm. Hand trenching with common labor is, however, the rule on most work. Few projects encountered by the average electrical contractor will be extensive enough to make power driven equipment economical.

In figuring trench work the estimator sketches a typical trench cross section for each duct group. Specifications usually state a minimum earth cover, thus the depth of the trench will vary with the number of vertical rows of ducts. Width will depend upon the number of ducts in a row with allowance for the spacing between the concrete envelop and the forms. The sides of the trench must be slanted outward from top to bottom at an angle depending upon the character of the soil.

From each of the cross section areas in square yards and the length of each size of trench, the amount of earth to be moved can be totaled.

The accompanying table shows the labor analysis in man hours for underground duct work.

MAN-HOUR DATA FOR UNDERGROUND DUCTS

EXCAVATING TRENCHES—to a depth of six feet.

Time per cubic yard.
In soft clay soil..... 2.0 m.h.
In hard clay soil..... 2.8 m.h.
For deeper trenches, add for double handling ..... 0.6 m.h.

BACKFILL—of all trenches, including tamping.

Time per cubic yard..... 0.5 m.h.

CONCRETE WORK—includes pouring and leveling of ready mixed concrete.

Time per cubic yard.
Base ..... 4.0 m.h.
Envelop ..... 3.0 m.h.

BUILDING FORMS—for concrete duct encasements.

Time per square foot..... 0.25 m.h.

REINFORCING STEEL—short sections laid in place.

Time per 100 linear feet of rod..... 3.0 m.h.

INSTALLING DUCTS—Covers laying 4-inch fibre ducts using precast separators.

Time per 100 linear feet of duct.
1 to 4 ducts per bank..... 8.0 m.h.
4 to 10 ducts per bank..... 7.2 m.h.

At best, estimates for underground work are accurate to only plus or minus 10 per cent. The above figures are based upon the experience of electrical contractors, doing their own work. All of the conditions encountered, the common labor available and the extent of the work vary the labor hour requirements. However, these figures will provide a useful guide of reasonable accuracy if used with appropriate consideration of the job conditions.

Data compiled from experience of a number of mid-west electrical contractors.

G-E Wiring Materials Help Provide EFFICIENT FACTORY LIGHTING

Good wiring is essential for the modern lighting that factories require for fast, efficient production. Wiring systems in new plants should be adequate for lighting requirements. Wiring systems in old plants in most cases should be made heavier. All of the wiring materials needed for good lighting are in the G-E line.

FLAMENOL* BUILDING WIRES
(For Rewiring Existing Raceways)

This new small diameter synthetic-insulated wire enables existing raceways to be rewired inexpensively. Simply replace existing wires in conduits with Flamenol Building Wires of larger capacity. Effective copper can be increased as much as 400 per cent in some instances. This wire is available in sizes 14 to 4/0 and is approved by the Underwriters' Laboratories.

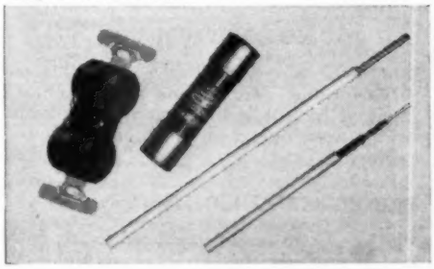
G-E CONDUIT, WIRE AND CABLE, WIRING DEVICES

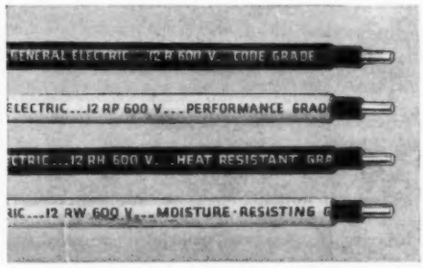
G-E White rigid conduit is hot-dipped galvanized and Glyptal-coated inside and out. Other G-E conduit products include flexible conduit, E.M.T., BraidX, BX, boxes and fittings. The G-E rubber-insulated wire and cable line includes Types R, RP, RH, and RW. The G-E wiring device line is complete including switches, lampholders, fuses, etc.

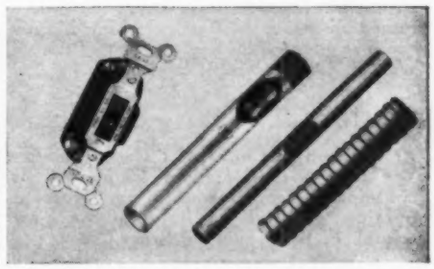
DELTABESTON WIRES

Deltabeston asbestos-insulated switchboard wire and Type AF fixture wire are especially designed for wiring lighting installations where heat is a problem. Deltabeston Switchboard wire will withstand inherent switchboard heat. Deltabeston Type AF Fixture Wire will resist the high-wattage lamp heat of modern lighting. It is approved for wiring all types of interior lighting fixtures.

*Reg. U.S. Pat. Off.




GENERAL ELECTRIC ...12 R 600 V... CODE GRADE
ELECTRIC...12 RP 600 V...PERFORMANCE GRAD
CTRIC...12 RH 600 V...HEAT RESISTANT GRA
IC...12 RW 600 V...MOISTURE-RESISTING



For further information about any or all of the G-E wiring materials see the nearest G-E Merchandise Distributor or write to Section G-0129, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut

GENERAL ELECTRIC

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Keep Up-To-Date on new developments

through this FREE SERVICE .....

Electrical Contracting brings you the latest literature of leading manufacturers without cost or obligation

WIRING HANDBOOK

1. A 24-page manual on modern home wiring practices. It contains detailed description of G-E home wiring methods, guide for checking and writing specifications, material specifications and series of convenient tables. General Electric Co.

POWER TRANSMISSION

2. A 160-page catalog, No. 82, giving detailed descriptions and illustrations of all types of equipment of the power transmission machinery field. T. B. Wood's Sons Co.

LIGHTING EQUIPMENT

3. Folders 681, 682 and 683 illustrating and describing fluorescent equipment for industrial, store and office lighting. Edwin F. Guth Co.

ELECTRICAL PRODUCTS

4. "Coltalog" No. 3, consisting of 84 pages of data, including safety switches, multi-breakers, service equipment, fuses and a complete listing of Sizes "0" and "1" motor control units. Colt's Patent Fire Arms Manufacturing Co.

MOTORS

5. Descriptive data 3105 covers type CS totally-enclosed-fan-cooled squirrel cage motors from one to 200 hp., for operation in locations where corrosive fumes, abrasive dust or splashing liquids are prevalent and for use out-of-doors. Westinghouse Electric & Mfg. Co.

LIGHTING

6. A booklet entitled "Recommendations for Classroom Lighting." It contains a discussion on room by room lighting as well as lighting the new school. F. W. Wakefield Brass Co.

MAGNETIC STARTERS

7. Circular No. 322 illustrating and describing the features of across-the-line magnetic starters. The Trumbull Electric Mfg. Co.

ELECTRICAL DEVICES

8. Catalog covering details on outdoor and indoor meter cabinets, transformer and special cabinets, test blocks and service entrance switches. Corcoran-Brown Lamp Division of Electric Auto-Lite Co.

FLUORESCENT FIXTURES

9. Folio 40F illustrates and describes fluorescent fixtures for commercial, industrial and residential applications. Gruber Brothers.

MOTORS

10. Bulletin B-6033 features coupled and engine type synchronous motors. Also covers types of starting equipment, including metal-clad and cubicle switchgear. Allis-Chalmers Mfg. Co.

CAPACITORS

11. Bulletin 190A shows capacitors for power factor correction of fluorescent lamps. Gives typical fluorescent lamp circuits with suggested connections for correction capacitors. Cornell-Dubilier Electric Corp.

CABLE

12. Bulletins GEA-3361 and 3362 tells how to terminate tellurium parkway, shielded, single-conductor cable and braided, shielded, single-conductor cable. General Electric Co.

FLUORESCENT LIGHTING

13. A 16-page folder illustrating and describing the Kayline fluorescent lighting. Price list is also given. The Kayline Co.

ELECTRICAL EQUIPMENT

14. Digest No. 124 gives information and illustrations on safety switches, multi-breakers, circuit breakers, service entrance equipment, panelboards, motor control and regulators. Square D Co.

WIRE AND CABLE

15. A folder telling the story of the research on wire and cable to search for facts and principles. It is profusely illustrated. The Okonite Co.

ELECTRICAL RACEWAY

16. A folder illustrating and describing the "inch-marked" Electrunite Steeltubes. Steel and Tubes Division, Republic Steel Corp.

MOTORS

17. Bulletins 403 and 404 illustrates reduction gearmotors for alternating and direct current. Bulletin 125 describes totally-enclosed fan-cooled induction motors. Reliance Electric & Engineering Co.

FLUORESCENT LIGHTING

18. A 4-page booklet covering twin lamp fluorescent RLM type luminaire designed for general or supplementary lighting in low bay industrial areas. Westinghouse Electric & Mfg. Co.

LENS LIGHTING

19. A 16-page folder illustrating and describing lens lighting. Many installation pictures are included. Claude Banks Co.

INSTRUMENT

20. Folder featuring clip on ammeter for a.c. operation. Ferranti Electric, Inc.

LIGHTING FIXTURES

21. Catalog No. 40, 244-pages, covers complete line of industrial lighting fixtures. Many installation photographs. Goodrich Electric Co.

HYDRAULIC EQUIPMENT

22. Catalog No. 40H shows illustrations, descriptions and specifications of hydraulic equipment, both hand and power operated. Blackhawk Manufacturing Co.

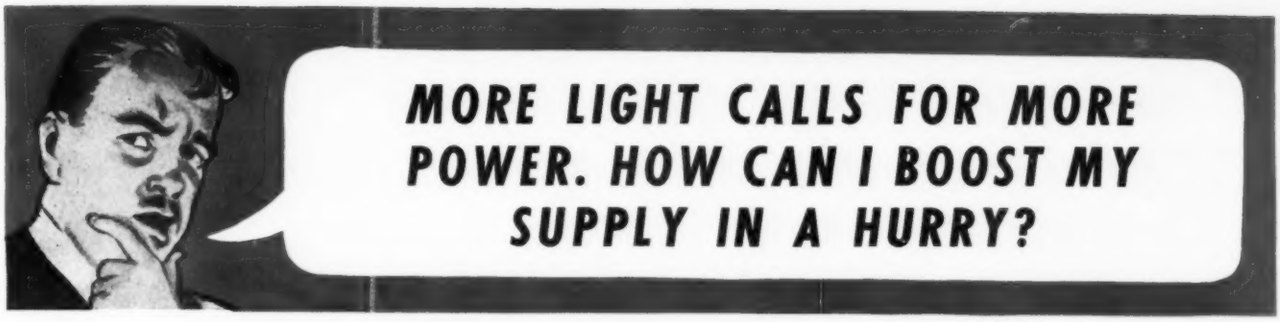
FLUORESCENT LIGHTING

23. A 46-page handbook and data bulletin on fluorescent lighting. It gives charts, diagrams, tables and photographs to show how and where to use fluorescent lighting to best advantage in factory, office and store. Benjamin Electric Mfg. Co.

ELECTRIC PRODUCTS

24. Catalog 402 featuring safety switches, service equipment, lighting panels, Kbl-duct, circuit break-

(Continued on Page 38)



YOU CAN PUT PYRANOL TRANSFORMERS AT LOAD CENTERS AND CUT INSTALLATION TIME AND COSTS

FOR new lighting circuits, G-E Pyranol transformers make possible speedy installations at a saving, plus the economies of load-center power distribution.

1. Pyranol—the G-E insulating and cooling liquid—is noninflammable, and Pyranol transformers require no fireproof enclosing vault. They can be located almost anywhere in the plant, even on overhead beams. You save time and the expense of vault construction.

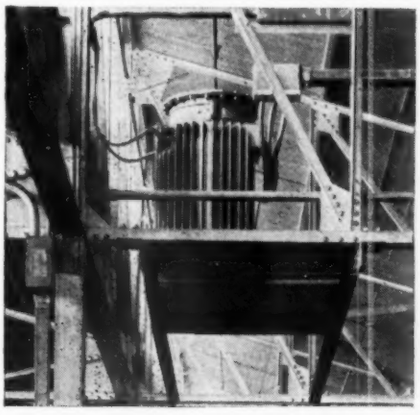
2. By putting Pyranol transformers at load centers you avoid long runs of secondary wiring, thus further reducing the cost of new circuits. Furthermore, shorter secondaries provide better voltage conditions and lower line losses.

A MODERNIZATION TIP

Frequently the capacity of your present wiring can be doubled or tripled by dividing it into short sections and installing a small Pyranol transformer in the center of each section. You avoid the expense of installing new secondary circuits. Savings up to 40 per cent have been made in the over-all cost of transformers plus feeders.

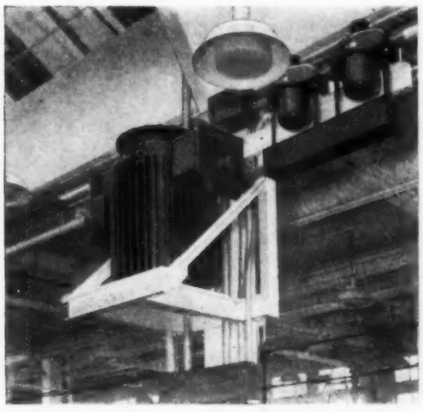
There's profit in load-center distribution with Pyranol transformers. Get complete information from the nearest G-E distributor or G-E Office. General Electric, Schenectady, N. Y.

SAVED $500 ON LOAD-CENTER INSTALLATION



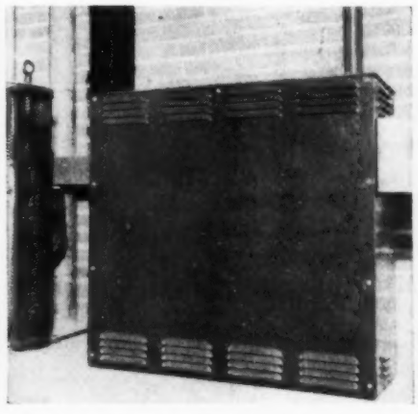
"We saved $500 on installed cost by using a Pyranol transformer to supply a lighting load," says R. H. Lewis, electrical superintendent, Motor Wheel Corporation, Lansing, Mich. No vault was required; installation time was materially reduced; valuable floor space was released because the transformer was installed on an overhead platform. Transformer rating: 100 kva, 480–240/120 volts

SAVED 40 PER CENT



Up near the ceiling, out of the way, here's one of three Pyranol transformers that brought savings of 40 per cent in the cost of modernizing a factory lighting circuit. When lighting was stepped up, the capacity of the existing wiring was increased by dividing it into three sections and installing a small Pyranol transformer at the center of each section. Rating of transformers: 100 kva, 2300–230/115 volts

SAVE WITH AIR-COOLED TRANSFORMERS, TOO



Located at a load-center, this G-E air-cooled transformer provides savings similar to those obtained with Pyranol transformers. Installation was simple, quick, and inexpensive. G-E air-cooled transformers are particularly well adapted to applications on circuits below 600 volts. Rating of the transformer illustrated: 50 kva, 480 to 120/208Y volts

402-19

GENERAL ELECTRIC

BETTER LIGHT MEANS BETTER PRODUCTION

ers and miscellaneous devices. Bull Dog Electric Products Co.

FUSE TONGS

25. Bulletin GEA-3030 features a sure-grip fuse tong for easy and safe handling of power fuses. General Electric Co.

EXTENSION LIGHT

26. Two folders illustrating and describing Reelite, an extension light that reels in and out like a window shade. Appleton Electric Co.

TRANSFORMERS

27. An 8-page folder describing door bell, chime and signaling transformers. It illustrates and gives detailed information on each device. Jefferson Electric Co.

WINDOW LIGHTING

28. A folder featuring reflectors, recessed units and fluorescent troughs for window display lighting. Claude Banks Co.

LIGHTING AND WIRING SYSTEMS

29. Catalog No. 15 gives description, installation instructions, illustrations and listings for this line of surface raceways and fittings; "Plugmold" multi-outlet assembly; "Pancake" overfloor systems. Wiremold Company.

RESISTORS AND RHEOSTATS

30. Catalog No. 40 covers illustrations, descriptions and price list of this line of resistors and rheostats. Hardwick, Hindle, Inc.

PANELBOARDS

31. A 4-page folder, F-8549, features Nofuze panelboards for lighting and power circuits in homes, buildings and industrial plants. Westinghouse Electric & Mfg. Co.

MOTORS

32. Bulletin No. B-6002 covers large direct current motors and control for heavy duty drives. Allis-Chalmers Mfg. Co.

CLAMPS

33. Folder on Kliplok clamps for fuse clips. Tells where to look for trouble and how premature fuse blowings, arcing at contacts and wasteful shutdowns can be eliminated. Trico Fuse Mfg. Co.

CONNECTORS

34. Second edition of Catalog No. 41. It contains additional engineering data relating to electrical connectors. Burndy Engineering Co., Inc.

TOOLS

35. Catalog illustrating and describing this line of portable electric tools. Black & Decker Mfg. Co.

LOCKERS AND FILES

36. Folder on lockers for commercial and industrial use and one on files. All-Steel-Equip Company.

INSTRUMENTS

37. Folder entitled "Where Accurate Knowledge Counts" illustrates this line of portable speed measuring instruments. Herman H. Sticht Co., Inc.

WIRE

38. Bulletin GEA-2733D describes and illustrates Flamenol, synthetic-insulated wire. Lists features, types. General Electric Co.

FITTINGS AND FIXTURES

39. Folder illustrating and describing explosion-proof Unilets and lighting fixtures for use in hazardous locations. Appleton Electric Co.

WIRING BOOKLET

40. A booklet entitled "Are You Sure Your Plans Are Complete?" is intended for the home-owner to bring to his attention many electrical conveniences. Pass & Seymour, Inc.

OILERS

41. Bulletin 27 illustrates and describes a new line of visible, automatic, unbreakable wick feed oilers. Trico Fuse Mfg. Co.

CAPACITORS

42. A folder entitled "Increase Profits with a Small Investment," takes as its theme, "Save $500 to $20,000 a year by improving power factor of your plant with capacitors." Cornell Dubilier Electric Corp.

DISTRIBUTION TRANSFORMERS

43. Bulletin B-6096 consisting of 16 pages of information on distribution transformers in ratings of 1½ to 25 kva. and standard voltage classes from 2400 to 7620 volts. Allis-Chalmers Mfg. Co.

FLUORESCENT FIXTURES

44. Bulletin F-32 features fluorescent light strip, reflectors and parts. It gives many phases and variations of applications. Day-Brite Lighting, Inc.

TRANSFORMERS

45. Catalog Section 44-100 consisting of 16-pages of data on dry type transformers, auto-transformers, boosters and phase changing transformers for applications where small kva. sizes are required. Westinghouse Electric & Mfg. Co.

MAGNETIC MOTOR STARTERS

46. Bulletin 504 covers the new across-the-line type magnetic motor starters, and also the overload relays and push button stations. Colt's Patent Fire Arms Manufacturing Co.

LIGHTING FIXTURE

47. Bulletin No. 92 illustrates and describes the Staklite, a fixture designed for book stack illumination. Goodrich Electric Co.

CONNECTORS

48. A 15-page booklet entitled "Electrical Connector Guide." Contains series of charts that make it easy to select proper connector and a suggested check-up chart for electrical circuits. Burndy Engineering Co., Inc.

MULTI-BREAKER EQUIPMENT

49. Circular No. 323 illustrates and describes this line of multi-breaker load and service centers. Also defines the applications of each type. The Trumbull Electric Mfg. Co.

FLOODLIGHT

50. Bulletin GEA-3317 features Novalux sports floodlighting equipment. Illustrations and specifications are given. General Electric Co.

ELECTRICAL EQUIPMENT

51. A merchandising catalog giving data on safety switches, service control, multi-breakers, knife switches, electrical specialties, refrigeration control and motor control. Cutler-Hammer, Inc.

FLUORESCENT FIXTURES

52. Catalog 40 illustrates and describes fluorescent lighting fixtures, surface channel strip, window reflectors, cove lighting reflectors, outdoor bracket-lantern. Claude Banks Co.

WIRING HANDBOOK

53. Hazakrome Handbook, Bulletin 200, type SN small diameter building wire for rewiring existing raceways. It tells how to figure installations and capacities; how others have solved rewiring problems and how to sell rewiring jobs. Hazard Insulated Wire Works.

FLUORESCENT LAMPS

54. An 8-page illustrated folder, A-3578, describing Type F fluorescent mazda lamps and their application for seeing, selling and decoration. Westinghouse Electric & Manufacturing Co.

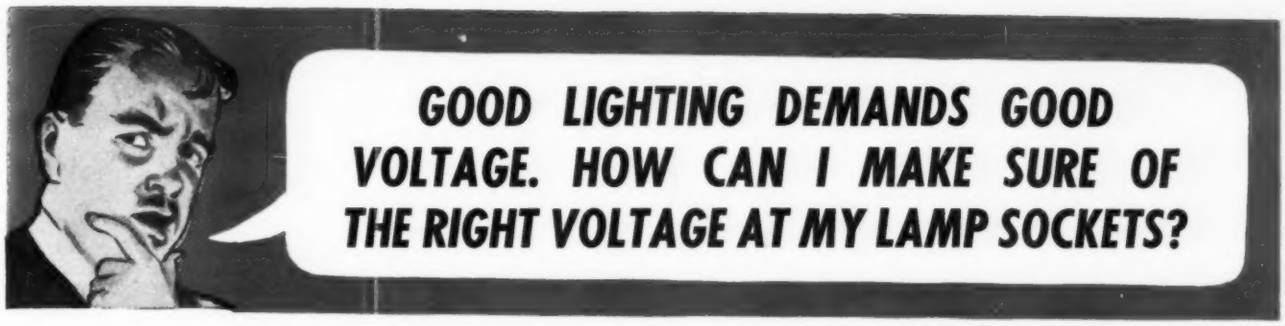
MOTOR STARTERS

55. Bulletin 404 gives description of manual motor starters including list prices, general information and application data. Colt's Patent Fire Arms Manufacturing Co.

POWER FACTOR CORRECTION

56. A 4-page bulletin on fluorescent-lamp power-factor correction. Tales and data on meaning of power-factor correction for fluorescent-lamp installations are included. Aerovox Corporation.

(Continued on Page 40)

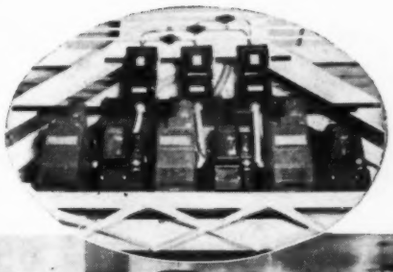


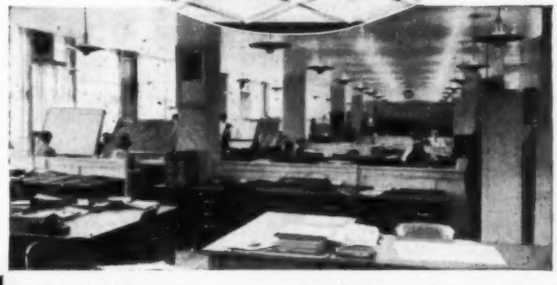
KEEP VOLTAGE—AND LIGHTING—AT CORRECT LEVELS WITH THIS NEW, LOW-PRICED G-E REGULATOR

PROPERLY regulated voltage on your lighting circuits can pay big returns through higher illumination, and consequent higher production, because *when voltage drops off, light levels drop much more.* That's why G-E automatic air-cooled induction regulators are finding increased use as reliable, low-cost aids to better lighting.

The compact design and light weight of these units make possible simple, space-saving installations. They can be installed almost anywhere indoors—even in basement or attic—without a fireproof vault. Regulation is smooth and accurate; ratings run from 1.2 to 12 kva, 120 to 600 volts—automatically operated (manual or motor operation also available). First cost is surprisingly low—and maintenance is practically negligible.

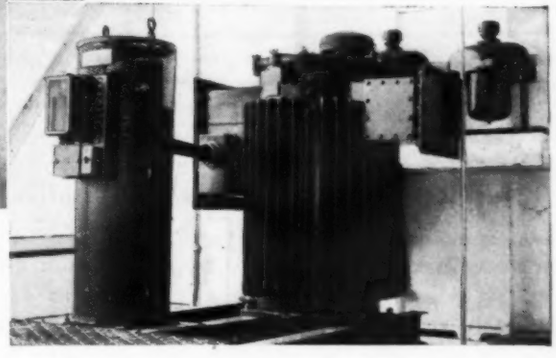
Call our local representative now—he'll be glad to help you select the proper regulator to keep your lighting *up*. General Electric, Schenectady, N. Y.

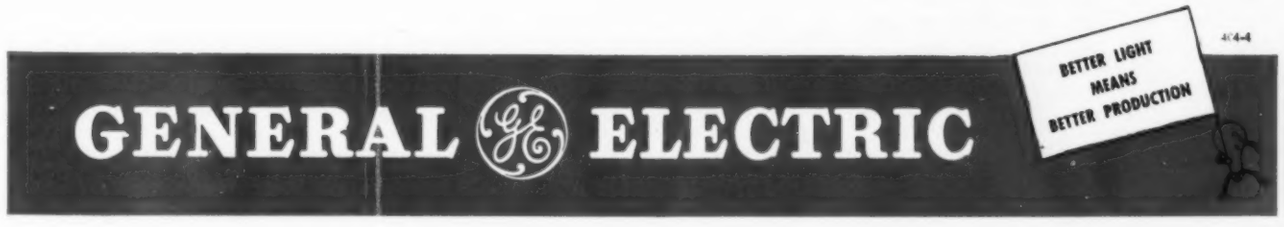




Tucked away on an overhead beam, this compact installation of three 1.5 kva, Type AIRS automatic induction regulators corrects the voltage drop on the long, heavily loaded feeders that supply power for the modern, indirect lighting of this large industrial engineering office.

Top-notch voltage for top-notch illumination is assured in this large eastern manufacturing plant by a G-E Type AIRS induction regulator. Valuable space was saved because the regulator could be placed overhead on a rack beside a G E Pyranol transformer.





SELLING

57. A booklet entitled "The Poor Wife's Revenge" is to help contractors obtain more and better wiring jobs. General Electric Co.

WIRE AND CABLE

58. Two catalogs illustrating and describing paper insulated power cables and Amerbestos asbestos insulated wires and cables. American Steel & Wire Co.

INSTRUMENTS

59. Bulletin 1650 covers instruments for measuring speed, frequency and rates of vibration. James G. Biddle Co.

LIGHTING

60. Bulletin F-30 illustrates and describes fluorescent show window lighting equipment. Charts for different type windows are included. Day-Brite Lighting, Inc.

BEARINGS

61. Data sheets on Ledaloyl, a self-lubricating sintered bearing. They give method of installation, operating temperature and characteristics. Johnson Bronze Co.

INDICATOR

62. Bulletin 400 illustrates and describes Knopp phase sequence indicator. Electrical Facilities, Inc.

MOTORS

63. A folder entitled "Split Phase Motor for Every Split Phase Application." Illustrations and construction features are given. Century Electric Co.

FLUORESCENT LUMINAIRE

64. A 2-page leaflet, 61-152, describing the new Type FPR twin lamp fluorescent luminaire for illumination of low bay industrial areas. Westinghouse Electric & Mfg. Co.

INSTRUMENTS

65. Catalog 4120 illustrates and describes panel Type three- and four-inch instruments for alternating and direct current. Roller-Smith Co.

CIRCUIT BREAKER

66. A 16-page booklet covering entire line of "De-ion" air and compressed air circuit breakers. Westinghouse Electric & Mfg. Co.

TUBING

67. Bulletin entitled "Irv-O-Lite, a new low-cost extruded tubing." It covers outstanding features, sizes. Irvington Varnish & Insulator Co.

SOLDERER

68. Bulletin illustrating and describing "Instant Heat," an electric solderer. Ideal Commutator Dresser Co.

LAMP GUIDE

69. A 23-page booklet, A-3618 is entitled "Fluorescent Lighting." It is a practical guide to the application of mazda F lamps and equipment. Illustrations of installations, wiring diagrams and tables of technical data are used. Westinghouse Lamp Division.

SUMP PUMP MOTOR

70. Bulletin GEA-3352 illustrates and describes fractional horsepower sump pump motor, with built-in float switch and automatic reset thermal-overload protection. General Electric Co.

EQUIPMENT GUIDE

71. A folder featuring this line of filing equipment, storage and wardrobe cabinets, lockers and shop boxes. All-Steel-Equip Co.

INFRA RED UNIT

72. A folder illustrating and describing features of Thermalamp, an infra-red unit. C. M. Hall Lamp Co.

LIGHTING FIXTURES

73. Catalog "L" consisting of 24 pages of data on fluorescent lighting fixtures. Illustrations, specifications and price list are given. Efcolite Corp.

CIRCUIT BREAKERS

74. Catalog No. 40 features magnetic circuit breakers—time delay and instantaneous types. Illustrations and curves are included. Heinemann Circuit Breaker Co.

INDICATING LAMP

75. Bulletin illustrating and describing indicating lamp and annunciator units, Type T2. H. R. Kirkland Co.

PENDENT LIGHTING

76. Catalog No. 71 contains data, illustrations, construction details on Monotube standards for pendent lighting. Union Metal Manufacturing Co.

LIGHTING

77. Bulletin No. 7-40 explains the principle and advantages of the Cold Cathode Method of fluorescent illumination for commercial, industrial and home lighting. National Transformer Co.

DRIVES

78. Bulletin No. B-6051-A illustrates and describes Texrope drives. Gives facts and data essential in estimating costs, types and sizes of V-belt drive equipment in every industry. Allis-Chalmers Mfg. Co.

FLUORESCENT LIGHTING

79. Catalog No. 112 illustrates and describes the complete line of fluorescent lighting fixtures. It consists of 48 pages of data. Daybrite Lighting, Inc.

CONDENSING UNITS

80. A 56-page booklet entitled "Low Cost, Dependable Condensing Units". It describes condensing units from 5 to 60 hp. for both refrigeration and air conditioning installations. General Electric Co.

LIGHTING

81. Pamphlet illustrating and describing fluorescent fixtures for commercial and industrial use. Grace Engineering Co.

SIGNALING

82. Catalog illustrating and describing signaling systems and devices with sections on bells, horns, buzzers; chimes; annunciators; transformers; push buttons; relays; fire alarm; telephones; hospital. Edwards and Company.

Circle numbers, sign and paste on a penny postcard or mail in an envelope.

ELECTRICAL CONTRACTING **September**
330 West 42d St.
New York, N. Y. **(Not good after November 1)**

Please send me without obligation, manufacturers' literature herein described and identified by numbers circled below.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
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COMPANY .....
ADDRESS .....
CITY..... **TITLE**.....

G.E. HAS A GOOD LIGHTING STORY, BUT WHAT DO I DO ABOUT IT? WHAT IS THE FIRST STEP?

General Electric Will Help Improve Your Lighting Quickly

HERE'S the way to go about it: If you want descriptive information on some of the products presented in the preceding pages, check them off on the large coupon and mail it immediately. Or if you wish, telephone or write the nearest General Electric office. Most G-E sales engineers have a good working knowledge of industrial lighting. If your conditions require a special analysis, they can put you in touch with General Electric specialists on outdoor and interior lighting, and on power distribution including voltage regulation, wiring, and protection. Or, they may refer you to a G-E distributor. Most likely, the economical answer to your particular lighting problem can be obtained quickly and with little trouble to you. Go after it today!

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Gentlemen:

Please send detailed informa tion on the products checked:

LAMPS

- ☐ Filament
- ☐ Fluorescent
- ☐ Mercury
- ☐ RF Fluorescent

FLOODLIGHTS

- ☐ GEA-3440—Lighted Yards Say "Keep Out"
- ☐ GEA-3311—Type L-68 Spun-aluminum Floodlight
- ☐ GEA-3050—Type L-43 and L-49 Spun-aluminum Floodlight
- ☐ GEA-1865—Novalux Floodlights
- ☐ GEA-3288—Novalux Sodium Luminaires
- ☐ GEA-2276—Novalux Form 79 Luminaire

BALLASTS

- ☐ GEA-3293—Ballasts for Fluorescent MAZDA Lamps
- ☐ GED-855—Transformers for MAZDA H (Mercury) Lamps

WIRING

- ☐ Adequate Wiring for Industry
- ☐ Flamenol Small-diameter Building Wire
- ☐ Deltabeston Asbestos-insulated Wire
- ☐ Conduit Products, Wire and Cable, Wiring Devices

TRANSFORMERS

- ☐ GEA-3377—Ways to Save with Load-center Distribution of Electric Power
- ☐ GEA-3180—Load-center Transformers Aid Factory Lighting
- ☐ GEA-2048—Pyranol Transformers
- ☐ GEA-897—Air-cooled Transformers

INDUCTION VOLTAGE REGULATORS

- ☐ GES-2285—What's the Answer When Poor Voltage Hampers Production?
- ☐ GEA-3057—Air-cooled Induction Regulators

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... STATE.....

451-18

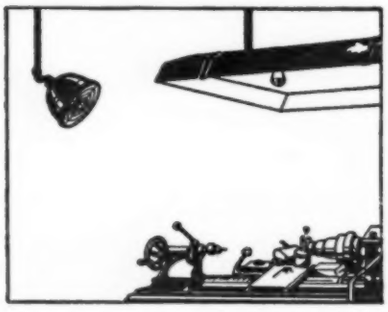
BETTER LIGHT MEANS BETTER PRODUCTION

GENERAL ELECTRIC

Better Lighting

MACHINE TOOL LIGHTING

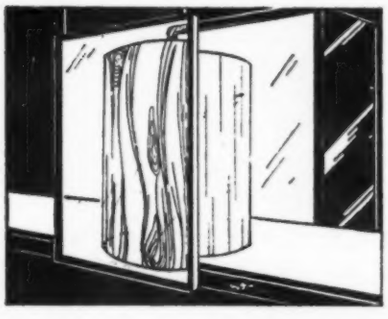
The seeing tasks in the majority of machine tool operations are similar, consisting of reading indicating scales, dials and micrometers, as well as observing the progress of the work. Be-



cause the measuring instruments generally have a semi-polished background, it is desirable to employ a large area source to minimize reflected glare and obtain high visibility. A concentrating source is frequently desirable to project light into deep boring operations.

POLARIZED LIGHT

The detection of strains and defects in glass, mounted lenses, radio tubes, transparent plastics, etc., is readily accomplished by polarized light. The

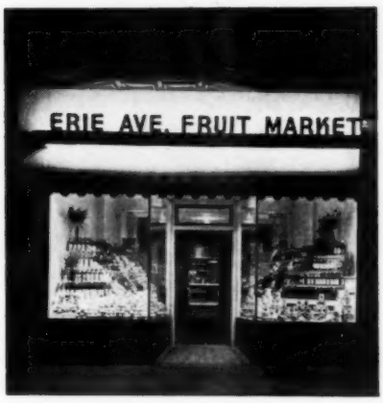


strained areas appear as color fringes in the material. With transparent models of structures and machine parts, it is also possible to see how they are strained under operating conditions.

MODERN STOREFRONT ILLUMINATION

Lighting and display combine to create a front that has real merchandising appeal. The sign consists of green porcelain-enameled steel letters mounted on a channel of the same material in front of a light-colored panel 6-feet high which covers the original transom over the show windows. Forty-watt lamps spaced 6-inches apart and mounted in the channel 18-inches from the background are used. Not only does this provide a sufficiently luminous background for the letters to be seen in silhouette, but there is also sufficient illumination provided to light both the entrance and the sidewalk adjacent to the windows.

Two-hundred-watt lamps in regular show window reflectors spaced 1-foot apart and recessed in a false ceiling



***SILHOUETTE SIGN** lighting and high intensity window illumination gives an appealing sales punch to the merchandise*

give the necessary sales punch to the front displays in the windows.

Lighting engineers of the Cincinnati Gas & Electric Company designed the installation.

FLUORESCENT FIXTURES

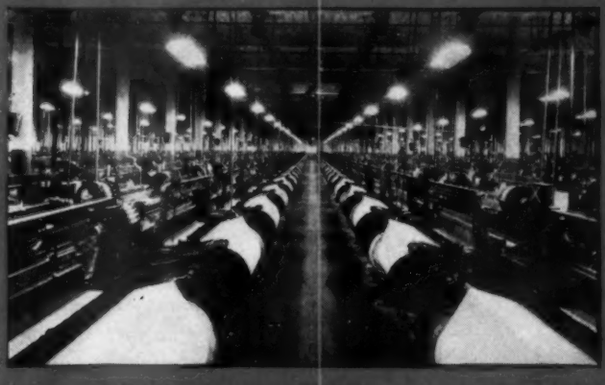
The fluorescent lamp has opened up a new field in fixture design, as indicated by the accompanying sketches which show three ways in which the lamp might be used in a theatre auditorium or foyer to help give a house the necessary distinction.

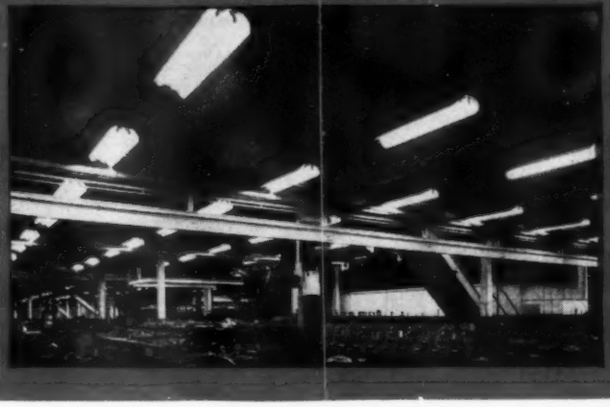
The wall unit shown in Fig. 1 consists of a reflector trough with polished Alzak sheet at the bottom. The fixture accommodates two 48-inch fluorescent

***ALZAK FOREST**—The cutting and sewing department in the Packard Motor Car Company body-finishing division needed good general illumination. So an installation of 800 Alzak-finished 300-watt RLM Reflectors was installed on 8 by 10 ft. centers. The result is about 28 foot-candles of easy-on-the-eye lighting.*

...FOR ALL INDUSTRIAL APPLICATIONS

For Two 48", 40 watt Fluorescent Lamps





DayBrite
"TWO-FORTY"
FLUORESCENT INDUSTRIAL FIXTURE

These unretouched photographs of typical Day-Brite "TWO-FORTY" installations graphically illustrate the wide range of industrial applications for these outstanding fluorescent fixtures. A modern bakery . . . a large textile mill . . . a machine shop — three widely diversified industries with one common requirement . . . **more and better light for improved working conditions.**

Note how in all of these cases an abundance of smooth, glare-free illumination is provided on the working areas . . . wiping out all harsh shadows and dark corners, and assuring maximum output and efficiency.

The "TWO-FORTY" has everything . . . high power-factor . . . Porcelain enamel reflector . . . ease of installation and maintenance . . . and a reasonable price.

Day-Brite's reputation for manufacturing quality, correctly engineered merchandise is nationally known. In selling Day-Brite fixtures, you are assured of satisfied customers and repeat business. It is profitable in the long run to concentrate on Day-Brite.

For the complete "TWO-FORTY" story . . . efficiencies, specifications and new low prices, **write for Bulletin F-28.**

Sold Through Your Electrical Wholesaler

DayBrite
LIGHTING, INC. ST. LOUIS, MISSOURI
2422 BULWER AVE.

THE NEW WHEELER
"DAY-LUX"
FLUORESCENT LUMINAIRES
FOR LIGHTING

Offices, Stores, Hotels,
Clubs, Restaurants,
Theatres, Public Buildings, etc.

Here is a new line of distinctive, beautifully designed Fluorescent luminaires made especially for general illumination purposes in commercial locations.

These fixtures furnish an abundant quantity of the soft, cool daylight illumination which makes seeing easy and working conditions ideal.

"DAY-LUX" Luminaires, which utilize 40-watt lamps, are available in two- or four-lamp construction.

All fixtures are supplied complete with white lamp holders, high power factor Tulamp ballast equipment, and removable and renewable separate starter switches located on the top of the units.

Reflectors are constructed of white enameled steel. Decorative end caps and canopy finished a beautiful crackled aluminum.

As illustrated, fixtures can be supplied with panels of frosted glass, or without glass.

All units are furnished with ballasts for 110-125 volts, 60 cycle A.C. operation.

Length of stems: 24" standard.

FOR MOUNTING CLOSE TO THE SURFACE

If desired for surface mounting, fixtures will be furnished with 6" stems.

FOUR LIGHT UNIT WITH GLASS PANELS

FOUR LIGHT UNIT WITHOUT GLASS PANELS

TWO LIGHT UNIT WITH GLASS PANELS

TWO LIGHT UNIT WITHOUT GLASS PANELS

For complete data write for New Bulletin No. 65

Distributed Exclusively Through Electrical Wholesalers

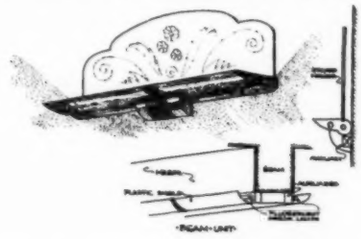
WHEELER REFLECTOR COMPANY
275 CONGRESS ST., BOSTON, MASS.

NEW YORK ATLANTA CLEVELAND

Better Lighting

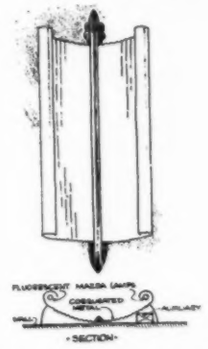
[FROM PAGE 42]

lamps which operate from a tulamp auxiliary located in the decorative housing at the center. One lamp is located so that the etched design in the mirror



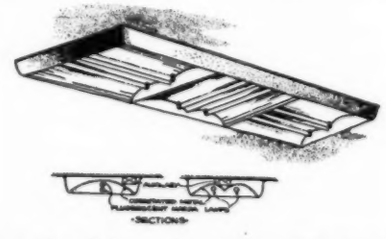
glows in color. The light from the other lamp in front is reflected to the ceiling; the mirrored surface prevents the wall directly above the unit from becoming uncomfortably bright. The detail shows how the trough may be used where there are beamed ceilings.

Fig. 2 suggests a way to apply the fluorescent lamp in wall units for foyers



and lounges. A lamp is placed at each side of a concave plaque of corrugated etched metal. The use of different colored lamps will produce pleasing multi-colored effects as the corrugations will pick up a reflection of each lamp. A section of curved plastics is used to shield the lamp and a decorative touch can be given to this by perforating the shield with any desired pattern.

To aid the eyes in adapting themselves to the brightness difference between the marquee soffit and interior, a unit such as sketched in Fig. 3 may be used. Two colored fluorescent lamps



are placed in each section. The background is of polished corrugated metal which picks up reflections of the lamps and helps in the transition.

Hazard Watertite rubber insulation is extremely moisture resisting and retains its electrical characteristics to a very high degree even after prolonged immersion: (tests on samples kept under water for 5 years actually show no loss of insulation qualities whatsoever).

Developed originally to meet the severe conditions encountered in coal mines, Hazard Watertite is exceptionally strong and tough having a tensile strength of about 2500 lbs. per sq. inch.

Hazard Watertite conforms to the requirements of Type RW Wires in the 1940 National Electrical Code for wiring in wet locations (Section 3035). Its use permits lighter and less costly cable assemblies and simplifies installation.

Write for full particulars.

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE CO.

WORKS: WILKES-BARRE, PENNSYLVANIA

New York Chicago Philadelphia Atlanta Dallas Washington Cleveland

Pittsburgh Buffalo Boston Detroit Seattle San Francisco St. Louis Los Angeles

BI-METAL PROTECTS

Ask your Westinghouse Representative for this BI-METAL demonstration

MAKE THIS TEST YOURSELF . . . A strip of Bi-Metal and a match are all you need to prove to yourself the time and moneysaving advantages of Bi-Metal Protection. Ask your Westinghouse Representative for a Bi-Metal Demonstration Kit.

HERE'S HOW BI-METAL SAVES MONEY . . . GIVES BETTER PROTECTION

Two different metals bonded together, when heated always bend in the same direction. The heat from short circuit or continued overload currents causes the Bi-Metal, which is exactly calibrated to the job at the factory, to act and open the circuit. Because of Bi-Metal's characteristics, its accuracy never changes, regardless of the number of operations. There's nothing to replace . . . there's nothing to wear out.

YOU PAY NO MORE FOR BI-METAL PROTECTION IN THIS WESTINGHOUSE EQUIPMENT

THERMOGUARD MOTOR
Single-phase sizes up through 2 hp. Impossible to burn out. Bi-Metal protection.

NOFUZE CIRCUIT BREAKER
Bi-Metal eliminates fuses. "De-ion" arc quenchers save contacts. Operates with cabinet closed.

"DE-ION" LINESTARTER
Magnetic motor starter. Bi-Metal overload protection. "De-ion" arc quenchers save contacts.

Westinghouse

WESTINGHOUSE ELECTRIC

All Circuits Automatically

..Without Fuses

You Get It For Both Power and Lighting Circuits in NOFUZE PANELBOARDS

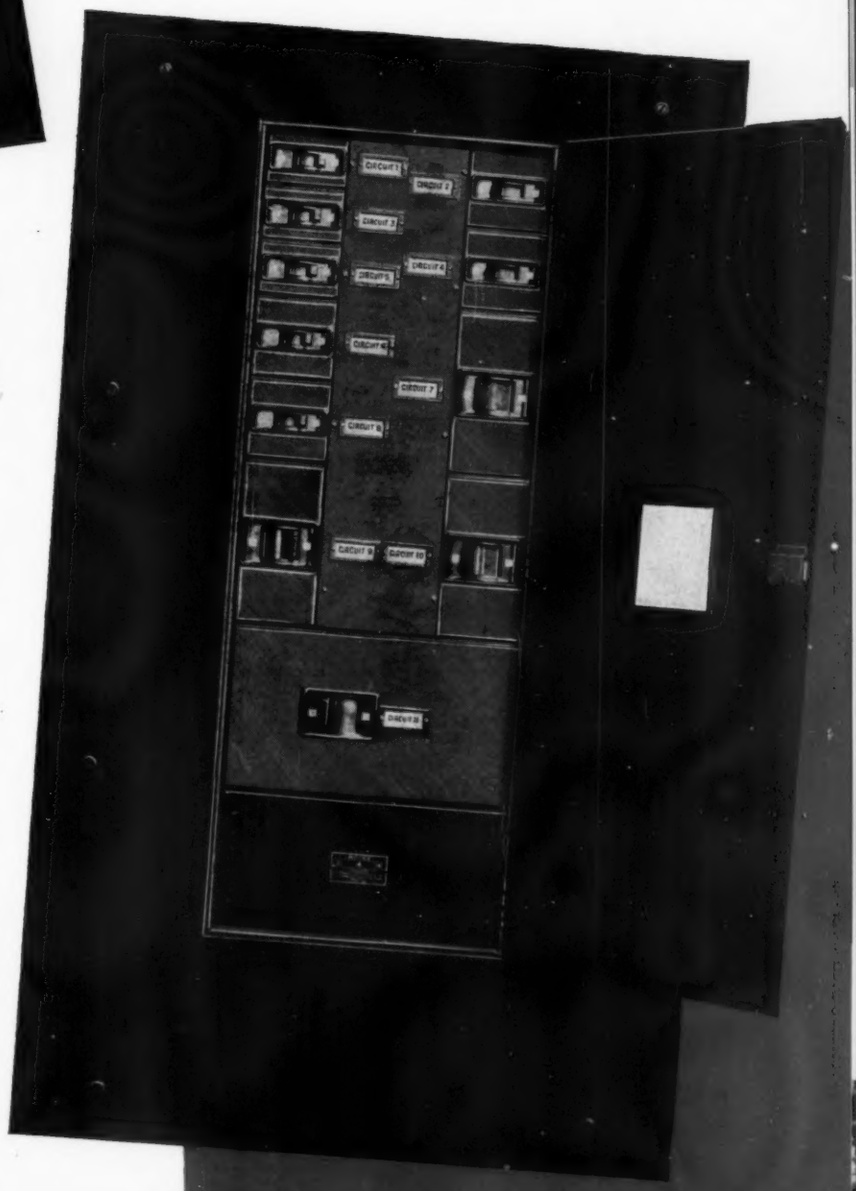
Bi-Metal protection for lighting and power circuits eliminates the necessity of replacing fuses. Saves lost production time, saves unnecessary interruptions to service.

The breaker trips automatically before dangerous current values are reached. Temporary or harmless overloads do not operate the breaker. When the breaker trips, service is restored by a simple movement of the handle. There is nothing to replace.

Nofuze panelboards are assembled from either of two types of breakers—the "De-ion" breaker for power; lighting and heating circuits, and the Multi-Breaker for low-cost lighting panelboards. You can have Multi-Breaker convenience at approximately the same cost as conventional fused equipment.

Ask your nearest Westinghouse wholesaler, district office, or industrial agent to show you the economy of Nofuze panelboards.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.



NOFUZE PANELBOARD

Bi-Metal protects circuits . . . eliminates fuses . . . "De-ion" arc quenchers save contacts on breakers used for power and lighting circuits.

J-90337

Motors and Control

THE OLYMPIAN

—an R.L.M. closed-end Fluorescent fixture; assures proper light control. Reflector and hood are separable. Uses two 48" fluorescent lamps.

Why YOU SHOULD DEMAND PORCELAIN ENAMEL FINISH

FREEDOM FROM REFLECTED GLARE

—ample diffusion of light eliminates all trace of reflected glare common to specular finishes.

PERMANENT—WEATHERPROOF

—can never corrode or tarnish to impair lighting efficiency; unaffected by atmospheric conditions.

EASY TO CLEAN

—reflector can be easily cleaned by merely wiping with a damp cloth to maintain full reflecting efficiency.

GOODRICH FLUORESCENT FIXTURES

Offered in a variety of sizes and styles for general and local industrial illumination. Reflectors and hoods are separable for easier wiring, installation, and maintenance. All Goodrich fluorescent fixtures are finished in vitreous-fired porcelain enamel. All are furnished complete with ballast equipment, replaceable starters, and adjustable brackets for chain or conduit mounting. Catalog sheets on request.

AVONDALE

—open-end fluorescent fixture. Uses two 48" lamps.

HILLCREST

—apertures direct a portion of light towards ceiling. Uses either two or three 48" lamps.

SOLD ONLY THROUGH ELECTRICAL WHOLESALERS

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 4602 BELLE PLAINE AVENUE, CHICAGO, ILL.

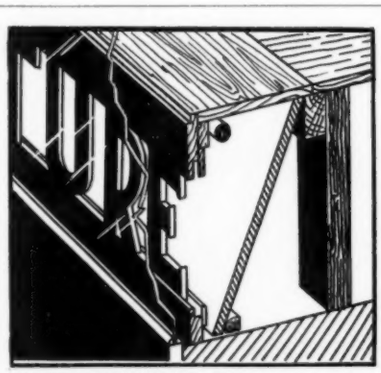
Better Lighting [FROM PAGE 44]

OUTDOOR LIGHTING FOR RAILROAD TERMINAL

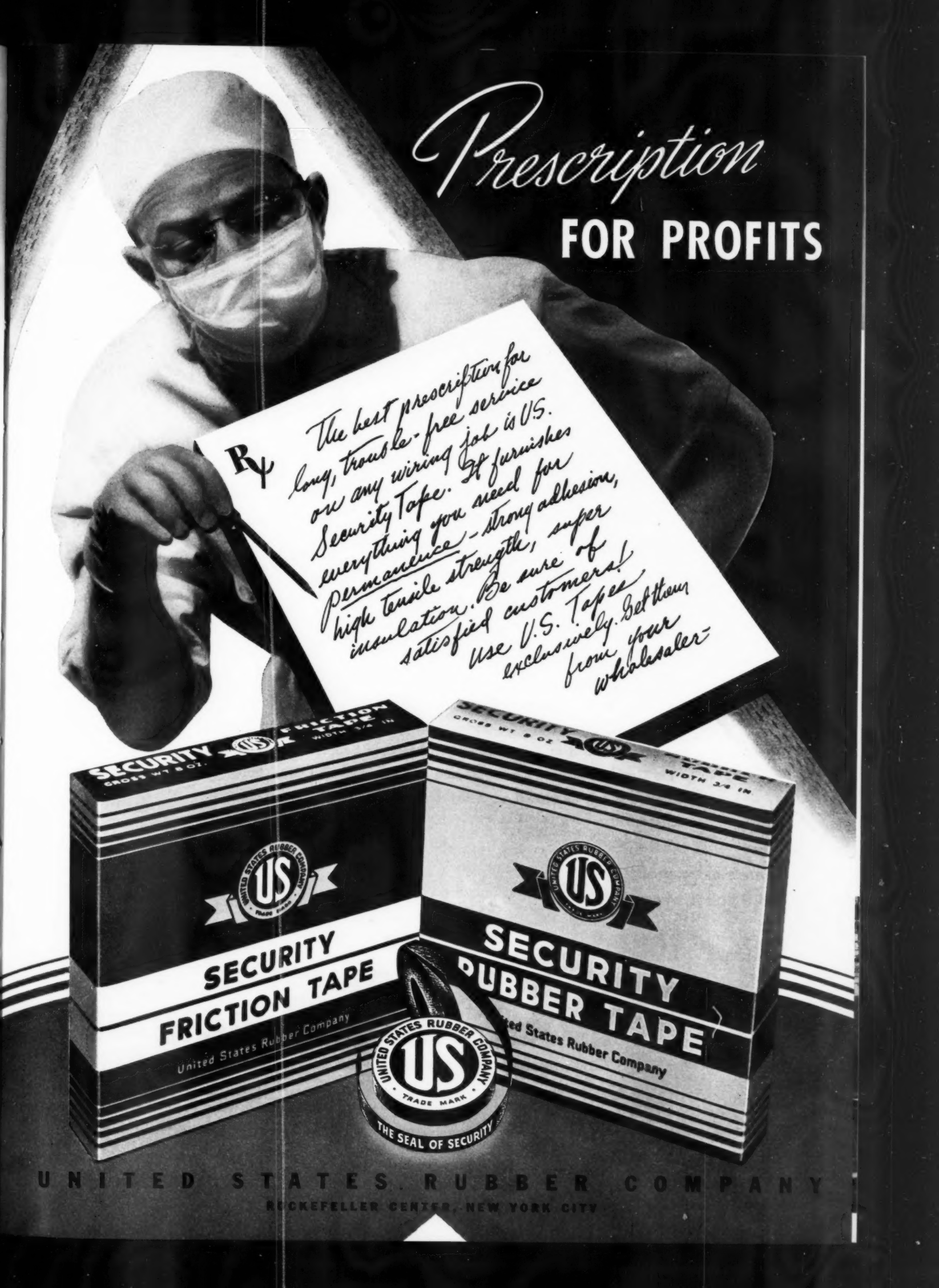
Ornamental luminaires and tropical landscaping furnish a brilliant unobstructed foreground for the new ultra-modern Los Angeles Union Passenger Terminal.

***DRIVING RAMPS** are brilliantly illuminated for night traffic at Los Angeles Union Terminal.*

The parking space has 34 reflectolux junior luminaires equipped with 500 watt lamps and special skirts, mounted on specially designed poles. The driveway area about the baggage, mail and express facilities at truck level is illuminated, for night operations, by 50 octagonal senior bronze and 21 junior pendant luminaires. Ten reflectolux junior asymmetric units light the street railway loading area. Pendants along the ramps are mounted on special aluminum brackets.



***SHOW WINDOW SIGN**—It is common practice to build a platform in windows where small articles are shown, to raise the floor closer to eye level. An attractive silhouette sign can easily be built into the platform by providing a slotted frame to hold cutout letters and concealed white or colored fluorescent lamps to light a white sloping background. A removable floor panel provides for relamping.*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℞ The best prescription for long, trouble-free service on any wiring job is U.S. Security Tape. It furnishes everything you need for permanence—strong adhesion, high tensile strength, super insulation. Be sure of satisfied customers! Use U.S. Tapes exclusively. Get them from your wholesaler
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FRICTION TAPE
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SECURITY
RUBBER TAPE
UNITED STATES RUBBER COMPANY
US
TRADE MARK
THE SEAL OF SECURITY
UNITED STATES RUBBER COMPANY
ROCKEFELLER CENTER, NEW YORK CITY

"—in the first place, this Nocrete Conduit is about half the cost of the metal pipe I figured on using. Then—because it handles easy, assembles and installs faster than *any* conduit I've ever used, it saved me a sum there, too! And—"

There are "ands"—advantages too numerous to mention. If you are interested in extra profits on underground jobs, large or small, call the nearest branch of either the General Electric Supply Corporation or the Graybar Electric Company and ask for facts on Orangeburg-Nocrete Conduit—the dual economy conduit that needs no concrete encasement.

There's extra profit for you in every foot of

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GRAYBAR ELECTRIC CO., INC.

NOCRETE CONDUIT

MADE AT ORANGEBURG, NEW YORK BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVENUE, NEW YORK CITY

ORANGEBURG

Standard for installation with concrete encasement
Nocrete for installation without concrete encasement

Industrial Electrification and MAINTENANCE

PREVENTING EQUIPMENT BREAKDOWN

TODAY industrial plants over the entire nation are expanding to meet the production demands of the National Defense Program. Small plants and large plants are stepping up their production schedules and machinery is being operated 16 and 24 hours a day. To stand up under these abnormal demands, the electrical equipment must be in A-1 condition. If it isn't—there are going to be failures, snutdowns and snags in production schedules.

This requires a careful check on equipment type, size and condition and a knowledge of the load requirements that must be met.

Once the equipment is chosen and operation begins, maintenance will be important—especially preventive maintenance—for shutdowns and the resultant production stoppages have no place in high pressure production schedules. All this falls on the shoulders of the maintenance man. He is the one responsible for the continuity of operation. He must have the facilities to make periodic inspections; he must have on hand, at all times, an ample stock of renewal parts—of sufficient quantity and variety to keep every piece of electrical equipment in operation. Makeshift adjustments and repairs should be eliminated.

How can the electrician go about this task of preventive maintenance of electrical equipment? How can he tell when a motor is on its last legs? How can he discover that the equipment is about to fail? What must he guard against? These and other questions are answered in this month's discussion.

Previous articles covered—

1. Simplifying Electrical Maintenance
2. Preventive Maintenance of Distribution Systems
3. Preventive Maintenance of Electrical Equipment (this issue)

Further articles will discuss—

4. Reducing Power Costs
5. Maintaining Good Power Factor
6. Meeting Severe Service Conditions
7. Safety Protection for Electrical Operations
8. Increasing Flexibility of Electrical Service
9. Providing Adequate Capacity for Increased Demand
10. Extending Automatic Control
11. Electrifying Operations to Reduce Unit Costs
12. Methods for Handling Changeovers and Live Circuits

Preventive Maintenance

Continuing the program for supervising industrial electrical systems. This article covers the maintenance of basic types of electrical equipment.

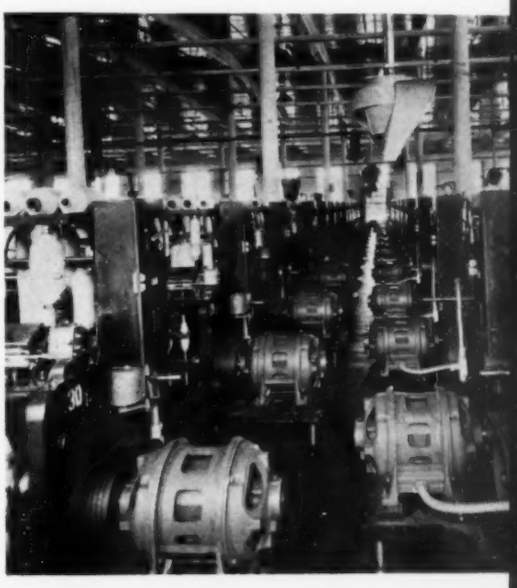
THE article last month dealt with the preventive maintenance of the distribution end of plant electrical systems. But, equally important is the maintenance of the electrical equipment that controls and operates the maze of production machinery in today's industrial plants. Maintain the production schedule, keep the wheels turning—that is the cry of today's industrialists. And the brunt of this task falls squarely on the shoulders of the maintenance man. His job is to see that everything operates in clockwork fashion. And if there is a hitch he will have to answer for it. To have assurance that plant operation will continue uninterrupted, the maintenance man should employ preventive maintenance measures. A few general points are outlined below.

1. MODERNIZATION of electrical equipment is just as important as that of distribution circuits. You might cross the continent in three weeks in an old jalopy. But you could do it in six days with a modern car—and without stops for repairs. And so with electrical equipment—you may make the grade with the present outmoded equipment and then again—you may not. With increased production demands and full capacity operation the gamble is too costly. Thorough checks should be made on disconnect switches, control equipment and motors, wiring and other equipment to determine if they will satisfactorily carry the continuous load demanded of them. If found wanting, new and modern equipment of proper type and size should be substituted.

2. MOTORS offer a good starting point for a detailed study of a preventive program. Some of the causes of motor trouble, such as low power-factor, will be discussed later in this series. But other conditions affect only motors and their maintenance.

Probably the most costly performance is the too common policy of letting motors run until they develop mechanical or electrical defects. With a little care this can be prevented. The first

EASY MAINTENANCE *and good ventilation is afforded these motors in a large textile mill. Note raised platforms and flexible connections to motors and machine-mounted controls.* (*Westinghouse photo*)



***OIL IMMERSED** starters in this sulphuric acid and fertilizer plant eliminate effect of acid fumes on copper contacts. (Westinghouse Photo)*

step is to keep a card record of every motor, showing name-plate data, approximate hours of service every year, and such periodically recorded operating data as the percentage of rated amperes at which motor is running.

Records can't prevent burn-outs due to the carelessness of machine operators, or failure to oil bearings, for instance. But records can show when a motor is nearing the end of its normal life, and will need attention. Perhaps the bearings of a given motor are good for 5,000 hours of service. If that fact is known, it is good practice to take that motor out of service when it reaches that limit and replace the bearings as a routine measure. Perhaps the motor could have run another 1,000 hours but then a burn-out would occur and an emergency call for a replacement motor, with production held up. The price of new bearings at 5,000 hours would have been cheap insurance against the burn-out that was sure to come soon after.

The same procedure can prevent unnecessary winding burn-outs and production stoppage. Suppose a motor is running at a temperature known to be warmer than normal. If experience shows that under such conditions a motor will only last 3,000 hours, it is wise to pull the motor out of service a little before that limit is reached. Similar procedure can profitably be followed on all motors subject to severe service, abuse or over-loading.

As following articles in this series will show, low voltage, low power factor or other defective conditions affect the life and the operating efficiency of motors, as well as other apparatus. In setting up a procedure for the preventive maintenance of motors these factors should be considered as well as the strictly local factors of over- or under-load, heavy service, and so on. To determine the actual effects of all these conditions, careful standard tests should be made at regular intervals. Increased winding temperatures, excessive load, decreasing insulation resistance, and other danger signals are easily determined if instruments are regularly and intelligently used. Some plants are using the modern socket type ammeters, inserted in the motor circuit at the machine and in plain view of the operator. A casual glance at this meter enables the operator to see if the motor is using current above its name plate rating. If this happens he can call the electrician and a check can be made. The ensuing check-up will reveal if the trouble is electrical or mechanical and a serious shutdown may be avoided. Where this method is not feasible and where controls are grouped near the machines these instruments are sometimes inserted ahead of the individual machine control.

3. CONTROLS of proper type and size for each motor are in themselves one of the best means of preventing trouble. The care of this equipment is vitally important for it is through controls that proper, dependable and effective operation is obtained. Control maintenance varies in scope from the dressing up of switch and magnetic starter contacts to that required by the vast and complicated maze of automatic inter-locking control circuits on many industrial processes. If controls are not carefully selected they may fail to perform effectively, and may cause endless trouble with their own defects.

A good general rule is to buy not only the best, but also the most complete controls. For example, the Code may allow the use of a mere across-the-line starter. Yet in many cases more expensive control, including under-voltage protection, may pay for itself several times over in the course of the year.

It should be obvious that every motor should have a control of exactly the correct rating—yet sometimes in the hurry of maintenance a used reserve control is taken from the stockroom and installed despite the fact that its rating doesn't match the motor. As an emergency matter, this practice is understandable; but all too often the incorrect control is left in service until the motor burns up, or until complaints come in that the control is stopping the motor too often.

Control enclosures are important. The usual enclosing cases of line switches, starters, controllers and overload protective devices give adequate protection from possible injury, accidental contact, flying chips, as well as dust, in normal atmospheres. Specially designed enclosures should be used in dusty atmospheres such as are met in foundries and wood-working shops. Similarly suitable enclosing cases should be used to meet hazardous or wet conditions.

Locating control and motors in separate rooms or enclosures reduces hazards and may cut the initial cost of equipment. Here is how Ditzler Color Co., Detroit, did it. They built five separate fireproof rooms which were open only to the outside. All motor starting and control equipment was housed in these cubicles and isolated from inflammable plant fumes.

4. OVERHEATING should be prevented. Generators, motors, induction regulators and transformers are usually designed to operate at an ambient or room temperature of 40 deg. C. Standard ratings are based on 40, 50 or 55 deg. C. rise in temperature above this point. If operated beyond this normal rise in temperature, the equipment is overheated. This tends to shorten the life of the insulation, reduce the lubricating value of oils and of course excessive heat represents wasted power.

Where the ambient temperature is over 40 deg. C., equipment designed for operation in hot locations should be used. As an alternative, either natural or forced ventilation can be provided to bring room temperature down to a reasonable level. In some cases, forced ventilation might be provided for the motor alone.

Overheating may sometimes be caused by restricting the free flow of air around apparatus. As an example, non-electrical equipment may be installed nearby which cuts off air circulation; or a home-made housing may be built around a non-enclosed motor in trying to keep foreign matter from

***LOAD INDICATORS** — ammeters — in the individual motor circuits of this group of controls in a paper plant show when the danger point in motor loading is being reached.*

PREVENTIVE MAINTENANCE GUIDE CHART

WHAT TO CHECK ON ELECTRICAL EQUIPMENT

The electrical equipment—motors and controls—in a plant is equally as important as the distribution facilities. It should be kept in first class condition. If not, trouble will follow. Plants rapidly expanding their production facilities will of necessity use machinery that has been idle for years—including electric motors and controls. But, before any of this equipment is placed in operation the following items should be carefully checked and the questions answered.

MOTORS

1. How old are the motors?

2. Are they of proper type and size to efficiently operate the machines to which they are connected?

3. Have the insulation, bearings, air gap and terminal leads been checked recently? Is there a record of the findings? Are these items checked periodically?

4. Are open type motors used in dusty or hazardous locations?

5. Do the motors overheat?

6. Are there any protective hoods over motors that might cut off natural air circulation? If so, can they be removed or can artificial ventilation be provided?

7. Are the motors conveniently located for easy cleaning and maintenance? Are the motors cleaned regularly when located in dusty atmospheres?

8. Are the motors located in such a manner as to be easily replaced in case of burnout?

9. Are all mechanical connections to the motor in the proper alignment?

10. Is the cause for motor overheating and burnouts really electrical or mechanical? Has the mechanical end of the machine been checked for frozen bearings, binding parts, heavy material loads?

11. Is there a sufficient supply of spare parts to take care of any emergency repairs?

12. Are all portable motors and equipment properly grounded?

CONTROLS

1. Are the controls of the proper type and size for the service required of them?

2. How old are they?

3. Do they have overload and under-voltage protection?

4. Are the heater coils of proper capacity to give adequate protection and continuous operation?

5. Are there locking devices on the disconnect switches or push buttons to permit locking circuit in off position for repairs?

6. Do magnetic starters "chatter"? Are the contacts pitted or burnt? Is the solenoid too weak?

7. Are there too many wires jammed in the control cabinet to permit free operation?

8. Are the controls easily accessible for repair and replacement?

LIGHTING EQUIPMENT

1. Are outlets properly located?

2. Are lighting units accessible or adjustable for cleaning?

3. Is there a regular cleaning schedule?

4. Are lamps properly guarded against breakage and vibration?

5. Are the proper type of fixtures installed in dusty and hazardous locations?

6. Are portable lamps insulated and grounded?

HOW TO PREVENT ELECTRICAL TROUBLE

The chief electrician of one large plant relies upon careful and regular testing of equipment to prevent machinery or wiring failures. But, he points out, you can't be testing all equipment all day every day. So why not adopt some simple, common sense methods that will be effective guardians every day against the more common electrical troubles? Here's his rule-of-thumb list of preventive measures:

1. Whenever an electrician is near a motor, he should feel bearings and main frame. If hand-hot, report to chief electrician for immediate test.

2. Instruct all new employees who are to operate electrically driven machines so they will recognize such signs of trouble as sparking, flickering of lights, odor of hot insulation and chattering of contacts.

3. Give special instructions to all new employees who work in hazardous areas. Warn them against unauthorized use of portable tools, removing burned-out lamps, and similar dangerous practices.

NOTE: *This matter of employee instruction is very important at present, because industrials are adding many new employees who may be inexperienced.*

4. Keep an eye on vapor-proof housing for cracks.

5. Keep an eye on metal casings for worn-out or misplaced gaskets.

6. Standardize on quality products throughout. If the purchasing department is price-minded, marshal all facts and get management's authority to insist upon getting what electrical department specifies.

7. Whenever the plant is shut down and the electrical department can do so, check these points:

A. Test for and clear grounds.

B. Check insulation resistance at feeders and compare with previous readings to locate signs of deterioration.

C. Test under-voltage relays and similar equipment which is not in frequent use.

D. Check foot-candle intensities at typical points and compare with previous readings. If low—

(1) Fixtures may need cleaning.
(2) Lamps may be old.
(3) Paint on walls and ceiling may need cleaning.
(4) Circuit voltage may be low.

8. Organize these "check-ups" into a simple routine. Make them "must" items in your work schedule.

reaching it. The housing may do a grand job of keeping wood chips, or grease, or other matter away from the motor—but it may shut off air too, causing heating.

Overheating can be prevented also (1) by removing dust, such as grain dust in corn and flour mills and sawdust in woodworking plants, from motors and control enclosures; (2) by removing foreign articles placed on the equipment; (3) by mounting all resistors in a vertical position, particularly those used frequently or continuously, such as on cranes; (4) by placing boxes of grid and ribbon type resistors end to end or beside each other instead of one box above another box.

5. VIBRATION AND NOISE—Vibration must be prevented if equipment is to be maintained in proper working condition, and if noise (high frequency vibration that is audible) is to be reduced.

To prevent vibration is quite difficult with some machines. However, some forms of vibration can be reduced or eliminated. Electrical machines with rotating members should be securely fastened to their supports, properly aligned with the driven unit, and adjusted for belt tightness to prevent flapping and pounding.

Cork, felt and rubber are used to isolate vibration. Manufacturers of these products have their own data for applications and their practical experience is available when vibration problems are submitted to them.

Because vibration is transmitted to stationary equipment and the plant structure, it is necessary that control, instruments, relays and other devices of a delicate nature be mounted so as to avoid loosened connection, chattering or rubbing and heating of small contacts, rapid wearing of precision parts and vibration of instruments or instrument pointers. In extreme cases, this equipment should be mounted on a separate base.

Insulation on wires and cables is affected in time by chafing in bends and at terminals of conduit. In one installation where conduit was suspended from roof trusses, conduit vibration was reduced by using a spiral spring loop to support the conduit. In another installation where the conduit is run on top of structural cross-members, a pad of rubber was used between the conduit and cross-members to absorb the vibration.

Where standard lamps are found to have a short life because of vibration the mill type lamp will be more suitable. Shock absorbing outlet box aligner covers as well as shock proof fixture sockets are also available.

A southern rayon mill had excessive lamp replacements. To overcome vibration and shocks to the lighting fixtures a U-shaped spring was attached to the drop cord so that the cord had a small loop. Thus the vibration was absorbed by the spring instead of being transmitted through the cord. The spring was made of No. 10 phosphor bronze smooth wire.

6. USE PAINT—Motor frames, control enclosures and belt, chain and gear guards are exposed to falling articles and are occasionally bumped. Conduit, wiring devices, transformers, motors and control may be kept in use where internal atmospheric conditions have changed, and are often used under conditions for which they are not designed. These are only a few of the things which cause damage to the exterior of electrical equipment. So in order to prevent exterior deterioration, usually due to corrosion, protective finish must be maintained by a regular schedule of painting or other finishing. A fresh finish, also enhances the appearance of the equipment. Color coding of conduits helps the electrician to readily pick out conduits of the various voltage circuits without a long and tedious job of tracing circuits or making tests.

SPARE ROTORS *mounted on this easily accessible rack provide for quick replacements in case of an emergency burn out.*

7. GROUND PORTABLE TOOLS—To prevent possible injury to the operator—buffers, drills, saws, sanders and similar portable equipment should have a third wire in the extension cord for a ground connection at the power outlet. This arrangement applies to tools used in maintenance as well as production, construction and other work in the plant. When the tools are inspected and serviced a test should be made to see that the third wire is not broken and that it is securely connected.

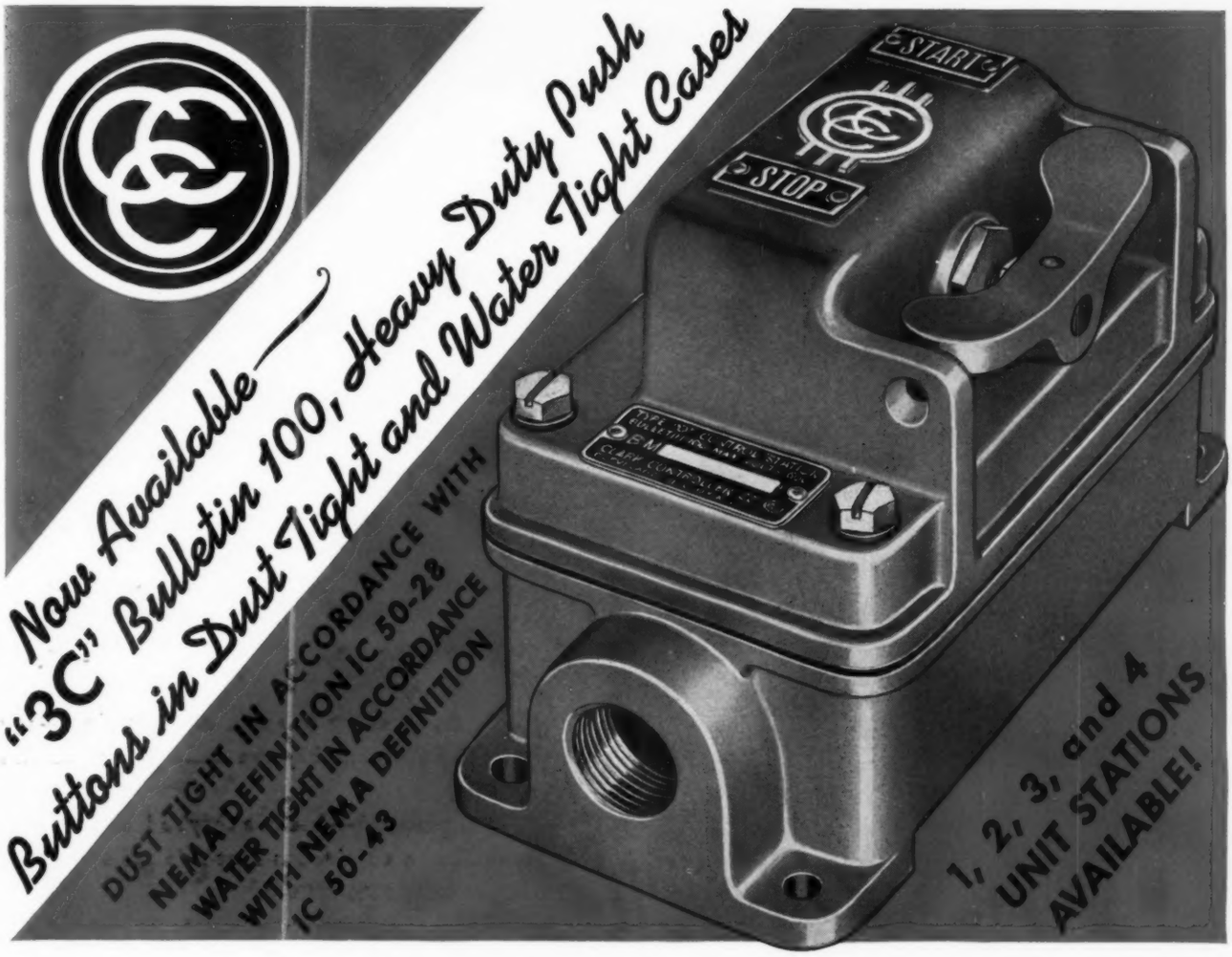
Many portable tools have open motors, which can be operated in a normal atmosphere. But they are not satisfactory for use in explosive atmospheres. For the latter condition suitable connection plugs, sockets and properly designed motors are required. In fact in hazardous locations, portable power tools should not be used. If the work must be done under these conditions extreme caution must be exercised, not only from the electrical but from the mechanical standpoint—even the cutting edge may strike a spark.

8. APPLY ELECTRIC HEAT to prevent equipment being damaged by moisture and to keep it in operating condition in low temperatures. An example of conditions in a Canadian pulp mill is cited. To keep the oil in compensators from congealing, strip heaters were placed under the oil pans.

9. "STOCK" RENEWAL PARTS—One way to keep equipment in operating condition is to replace wearing parts before they have reached a dangerous condition.

Sound preventive maintenance calls for a complete set of spare controls to be kept on hand, with at least one unit for each size and type of motor. In addition, there should be an ample supply of contacts, relay coils and other parts to make quick repairs.

An adequate supply of spare motor armatures of different sizes should be kept on hand for ready replacement in case one burns out. In the case of smaller motors a spare stock should be kept for quick replacements. If this isn't feasible, arrangements should be made with a reliable motor repair shop for rental motors to be used while the damaged one is being repaired. This supply of renewal parts should be available either in the main stockroom or at various locations, as in principal departments and buildings. One of the curses of emergency repairing is the need for fashioning a make-shift part. A well-regulated stock of parts eliminates this trouble. Along this line, a word should be said about the practice in some plants and repair shops of making up "home-made" spare parts. This may seem like an economical method, since scrap metal and otherwise unoccupied labor hours go into these make-shift spares. But usually the manufacturer of the original equipment has given great thought to the design and manufacture of every part of his product, and can provide spare parts that will be far more satisfactory than home-made parts—and cheaper in the end.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STOP
DUST TIGHT IN ACCORDANCE WITH NEMA DEFINITION IC 50-28
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● And what an enclosure! Cast aluminum with evenly machined surfaces between cover and base • • • exterior operating mechanism and stuffing box mounted in the cover • • • small nut on operating shaft for adjustment of stuffing box • • • drive screws hold gasket firmly to cover • • • gasket can't buckle • • • can't come loose, can't get lost • • • gasket holes always in perfect alignment with holes in cover and base. Pilot lights with color caps for interchangeable mounting with units are available.

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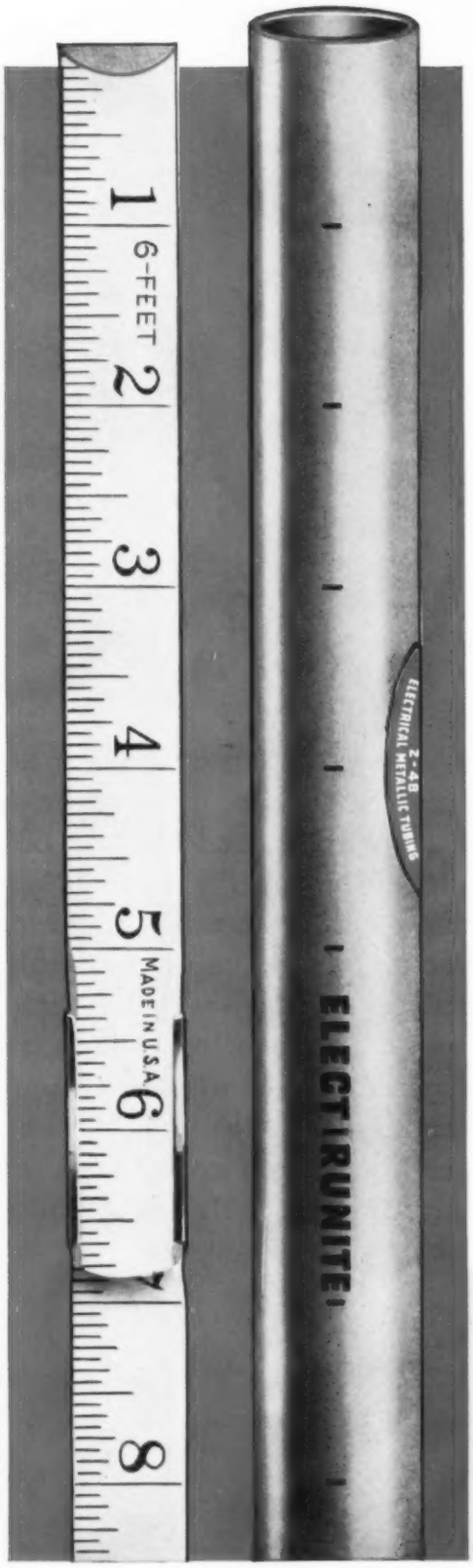

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Cut pieces and bends that always fit can be made easily and quickly. There is less chance for error — no need for guesswork — consequently, less waste of material.

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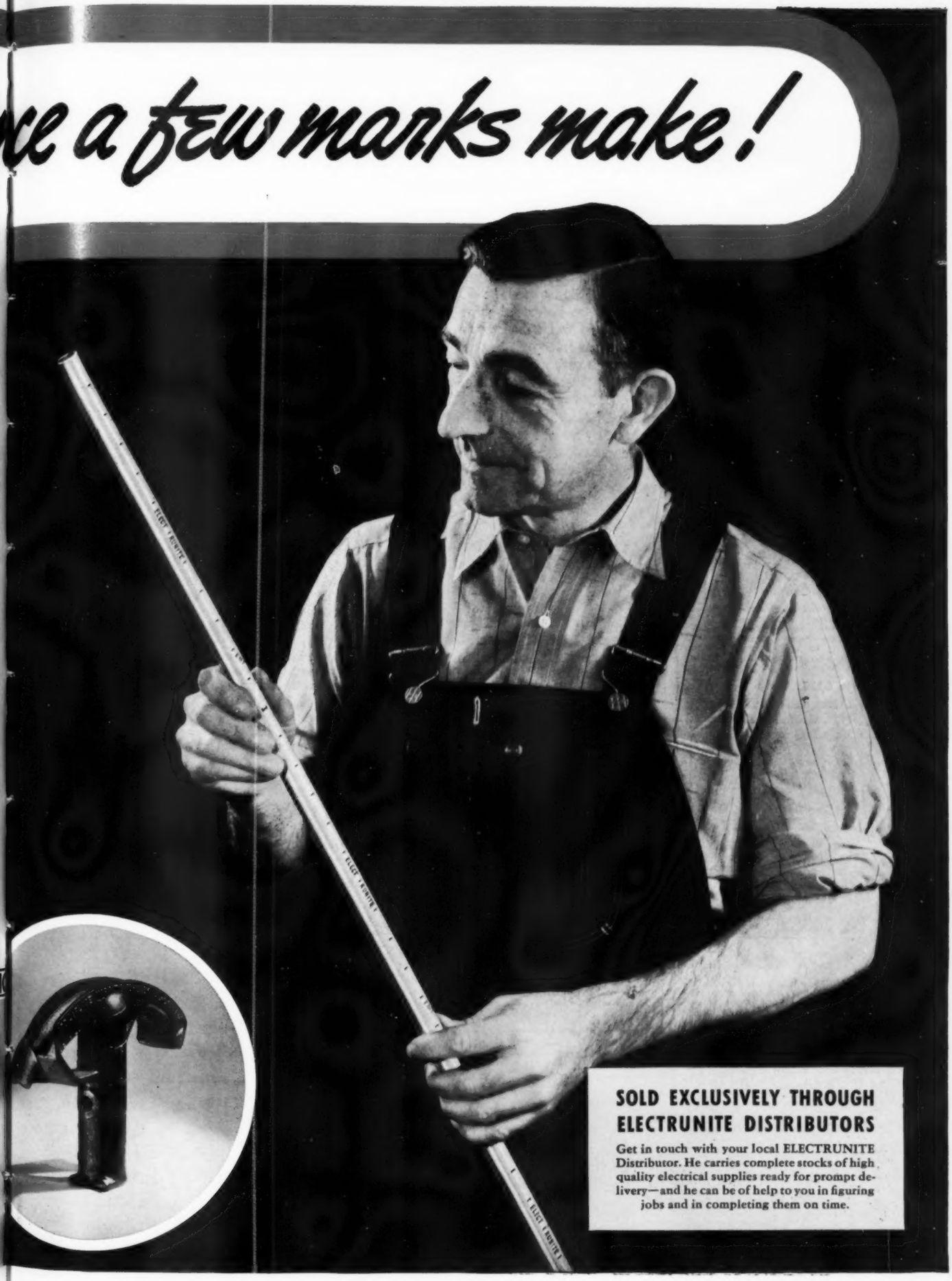
The new ELECTRUNITE Bender, shown at the right—with built-in instructions—makes any standard type or radius bend easily, quickly and accurately. The new bending tag, supplied with each bundle of tubing, provides detailed bending instructions and diagrams. And the new red and black label combines with "inch-marking" to identify genuine ELECTRUNITE STEELTUBES.


...xe a few marks make!
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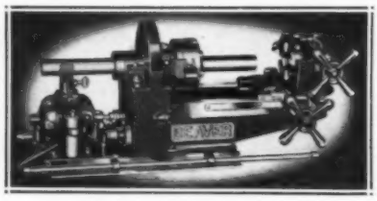
Get in touch with your local ELECTRUNITE Distributor. He carries complete stocks of high quality electrical supplies ready for prompt delivery—and he can be of help to you in figuring jobs and in completing them on time.

BEAVER

Pipe and Bolt Machines

From $125.00 Up!

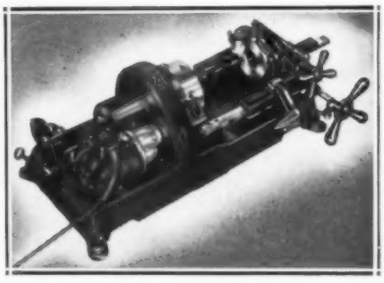


Model-A

A high-speed heavy-duty deluxe Pipe and Bolt Machine. Range ⅛ to 2-inch-up to 12-inch with geared tools and drive shaft. Bolts, ¼ to 2-inch. Wt. 415 lbs.

From $309.50 up

Write for Bulletin A



Model-B

Big Brother to Model-C Power Unit. A light-weight utility Pipe and Bolt Machine combining many features of Model-A with the easy portability of Model-C. Range ⅛ to 2-inch up to 8-inch with drive shaft and geared tools. Bolts up to 1½-inch. Weight 280 lbs.

From $217.50 Up

Wr[redacted]n

Models C-1 and C-2

A sturdy little Power Unit Converts hand pipe tools into power tools from ⅜ to 8-inch. Threads 8-inch in 6 minutes. Threads bolts up to 1½-inch. Two men can work at the same time without interference. Weight 150 lbs.

From $125.00 up

Write for Bulletin C

Write for new Tool and Machine Catalogue—Just off the press

BEAVER PIPE TOOLS

940 Deen Ave. Warren, O.

Finish of Panels Protected by Oil

A small amount of light machine oil applied with a soft cloth to dull black lacquered switchboard panels, new or old, will protect the finish almost indefinitely. The oil is applied in a thin, even coating. Then after several hours the surplus oil should be removed with a clean, slightly oiled cloth.

By this procedure the panels, whether they have been in service for a long time or are extensions of new equipment, can be given a uniform appearance. Dust will be less conspicuous than on untreated panels, after the surplus oil has been removed.

When a damaged spot on a panel is to be repaired carbon tetrachloride or a similar solvent can be used to remove the oil. After the repair, the finishing coat of lacquer should stand at least 24 hours to give the thinner time to evaporate completely. Then, oil is applied to protect the finish of the repaired spot.

Graphic Meter Helps Save $10,000

Investigations of operating conditions, whether in relation to condition of equipment, use of power, handling of equipment by workmen, or study of labor losses, require accurate and complete data. The maintenance man can assist in obtaining the data by using graphic recorders. That performance studies with graphic instruments are really profitable, is well illustrated by the following example—

In a Minneapolis manufacturing plant, the electrical engineer made a careful study of the performance of each motor-driven equipment, with the aid of a graphic wattmeter. If the drive was inefficient, it was changed. If the motor was too large or too small, the correct size was substituted. If the friction load was too high, the cause was found and eliminated. Three years were required to do the job—but it paid. Power savings of $10,000 were effected despite a 25 per cent increase in tonnage. The accompanying graphs, F1 and F2, "before" and "after," illustrate the improvement in power consumption.

Hazardous Location Terms

This brief explanation of principal terms, used in connection with equipment for hazardous locations, is presented for quick review.

Hazardous Location—A location in which the atmosphere is laden with gas or dust in such proportion as to create a potential hazard to life and property.

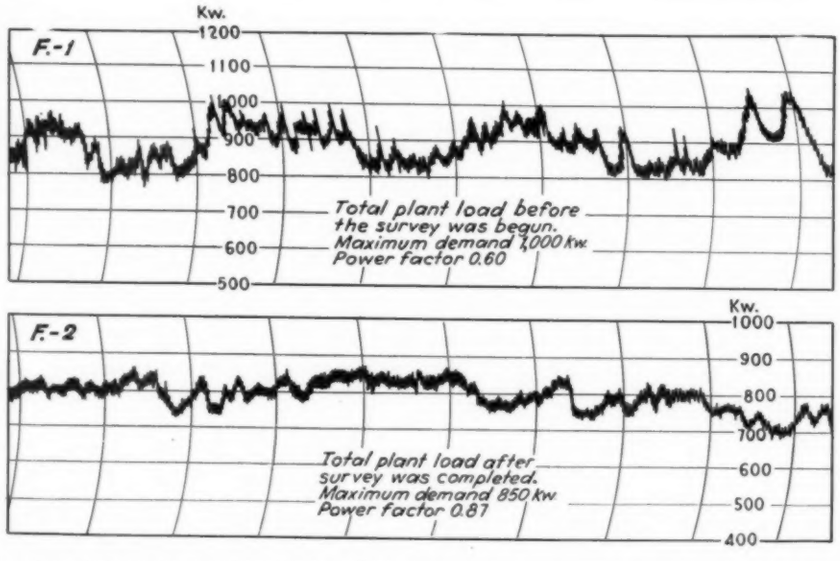
Internal Explosion—An explosion which occurs within an enclosure when the proper proportion of accumulated gas and air is ignited by a spark generated during the make or break of an electrical circuit.

Explosion-proof—Capable of withstanding without injury an internal explosion of specified flammable vapors, and without transmitting the flame to the outside atmosphere.

Explosion-resisting—A term used originally when referring to explosion-proof equipment. The term explosion-proof has been since officially adopted.

Dust-tight—So constructed that dust will not enter the enclosing case, and deposits of dust on equipment will not cause overheating under normal operating conditions.

Dust-proof—So constructed or protected that accumulation of dust will not interfere with operation. Such equipment might be a source for ignition of dust.



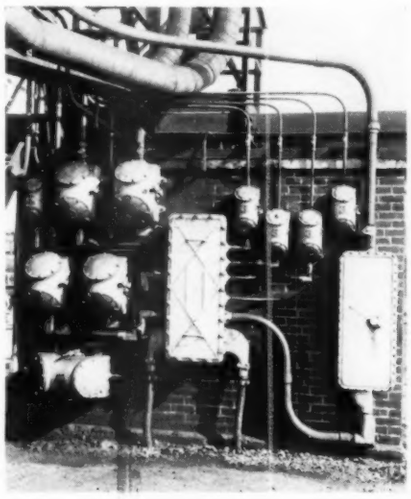
***GRAPHIC WATTMETER RECORDS** illustrate improvement in power consumption which resulted in a saving of $10,000 while tonnage increased 25 per cent. (Esterline-Angus Graph)*

Metal-to-metal Surface—An accurately ground or finished surface between cover and enclosure of specified length, which prevents the passage of flame to the outside during a period of internal explosion.

Dead End—A term applied to plug receptacles and referring to an intermediate set of contacts which slide in the explosion-proof chamber. All contact poles are dead when plug is inserted or withdrawn.

Interlocking—A device actuated by a switching lever, which prevents withdrawing a plug from a receptacle while current is on.

Sealing Cement—A special mixture used with water, that sets especially hard. It is used to isolate an arcing chamber from contact with the rest of the conduit system. Note that it is compulsory to use



AT AN OIL REFINERY—A typical main junction box (center) and Deion branch-feeder breakers in explosion-proof housings.

the sealing cement recommended by various manufacturers of fittings in order to comply with Underwriters' Laboratories' requirements.

Flash Point—Temperature at which a liquid commences to vaporize in sufficient quantity to form an ignitable mixture with air.

Ignition Temperature—Lowest temperature without application of flame or spark at which an ignitable mixture of vapor and air, reach combustion.

Upper Limits—Relates to the high limit of concentration of any flammable substance, in terms of percentage of vapors in air by volume, beyond which point combustion will not take place.

Lower Limits—Relates to the low limit of concentration of any flammable substance, in terms of percentage of vapors in air by volume, at which point combustion takes place. Explosions occur between the upper and lower limits.

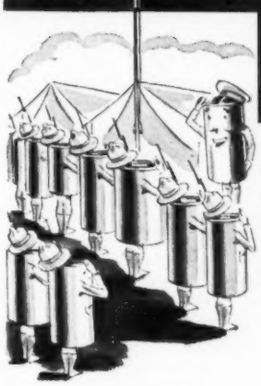
Volatile Liquid—Any liquid which vaporizes and mixes readily with air.

Flammable Gases—Gases which form explosive or flammable mixtures with air.

Take Care of Tools

Every portable electric tool has a rated capacity. Users should know the rating and exercise care when the tool

THE BEARINGS ARE *Already* MOBILIZED



EVERY SIZE REQUIRED IN PRODUCTION OR MAINTENANCE OF INDUSTRIAL MACHINERY

COMPLETELY MACHINED AND FINISHED READY FOR INSTANT ASSEMBLY

● Electric Motor Bearings are available from stock for all makes of motors from 1/50 hp to 100 hp. Write for catalog . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in all Principal Cities.

Save time, money, trouble servicing motors with Bunting Bearings.

BUNTING

BRONZE BUSHINGS · BEARINGS
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STRONG, NEAT CONNECTIONS!

TELESCOPE BM SYSTEM

Nothing clumsy about the way B-M connectors and couplings do the job . . . no chance for sags or slips. Squeeze the patented B-M Indenter twice and you're SURE it's done RIGHT.

ALSO: ● Save 25% on materials. ● Save 25% to 50% on time. ● Quick, easy installations. ● Eliminate complications. ● No fussing with nuts to tighten.

Speed and Accuracy for More Profit!

$1.25 Buys the One Tool Needed

This one patented tool (½" Indenter) handles 80% of all installations. Pays for itself many times over on the very first job.

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Like an OLD HAT

CARBON BRUSHES, Too Become Obsolete . . . .

That's why you should have the NEW

FREE	Brush
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Every man interested in electrical products, service, or engineering should have this catalog on file for reference. As up-to-date as tomorrow!

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Whether it's furnishing requirements for fractional h.p. motors, brushes to meet an unsolved problem, or engineering counsel, get SCP Service.

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● THE *NEW* WAY TO DRILL HOLES IN CONCRETE, TILE, etc.

50-75% FASTER!

Amazing new drill-point contains special metal harder than hardest steel. Goes through concrete, tile, slate, porcelain, etc., 50 to 75% faster. Drills cleaner, more accurate holes. Speeds up installation of expansion anchors. Saves your skilled time for more profitable work. Eliminates noisy hammering, monotonous chiseling. Doesn't splinter fragile work. No special equipment needed—use in any rotary drill. Get *your* share of those extra profits now possible. Send coupon for leaflet.

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CARBOLOY
MASONRY DRILL-POINTS

is light for the job. Avoid overloading the electric tool.

Armatures are burned out by using dull tools which overload the motors. Cutting tools should be kept sharp.

New armatures cost more than a new set of brushes. Carbon brushes should be inspected frequently and replaced by the type recommended by the tool manufacturer.

Electric Hoist Saves Time and Labor Costs

A Cleveland photo-lithographer located on a second floor was handicapped because there were no elevators in the building. Only a dumb-waiter of 500-lb. capacity was available for elevating paper stock and lowering finished product ready for shipment.

To solve the problem, the company installed an electric hoist and a short overhead track system which projects 5-ft. beyond a double doorway at the rear of the building. The hoist has a lifting capacity of 1,000 lb.; the motor operates on a 220-volt, 3-phase, 60-cycle circuit and developes 1¼ hp.

In order to support the projecting end of the track, an I-beam was fastened to building supports on the roof and extended beyond the wall. A cable support was fastened from the I-beam to the hoist track below.

With the hoist installation one ton of

ONE-HALF TON HOIST reduces handling time 66⅔ per cent.

For Better Service—

INSTALL **TRICO** REG. U.S. PAT. OFF.

RENEWABLE FUSES
With the famous Powder-Packed Element

KLIPLOK CLAMPS
Lock fuses and clips together

KANTARK FUSES
With genuine fibre tubes (not paper)

COLORTOP PLUG FUSES
The color tells the size

FUSE PULLERS
Pull and replace fuses safely

GLASS OILERS
For motors, line shafts, solid bearings etc

UNBREAKABLE OILERS
"Opto-Matic" Constant level type
Gravity Feed type

WRITE FOR FOLDER CPF-300

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

MAKE MORE PROFITS WITH ELECTRIC DOOR OPERATORS

See our Ad, Page 168 of 1940 Electrical Buyers Reference

DOORS and OPERATORS, Inc.
Tiffin, Ohio 528 Hudson St.

NEW SpeedWay Not only far more for the money — actually more drill.

1" DRILL

A tool and a price made possible by SpeedWay's 30 years' specialization in portable electric tools, and modern production methods. Every new feature: Streamlined, die cast case, forced air cooling, natural grip in line breast plate handle, removable side handle, sliding switch, waterproof cord, molded plug, and a stallproof specially wound, high torque, 500 RPM, 115 V Universal SpeedWay Drill Motor.

If your dealer can't supply, order direct on 10 day trial.

$24.50

Circular Free

SpeedWay Mfg. Co., 1866 S. 52nd Ave., Cicero, Ill.

paper can be unloaded from a truck and raised to the second floor in three lifts, whereas about nine lifts were required by the dumb-waiter; thus the complete unloading operation requires only one-third of the time.

Total cost of the equipment was approximately $350. The installation has made a saving in time and labor costs in raising paper stock and lowering shipments.

Special steel carts, with one side open and rollers on the bottom, were built to carry the loads. When one cart is elevated, the hoist man slides it into the plant on its rollers. Then he hooks an empty cart and lowers it to the man below. While the latter is loading the cart, the man in the second floor can be unloading the full cart; so both men can be working at the same time.

Gun-welders Reduce Rejects and Maintenance

Electronically controlled gun-welders have replaced former methods to assemble automobile bodies in some plants. Seventeen equipments are in use because the welders speed assembly give a stronger bond, and reduce rejects to a minimum. The electronic control prevents burned spots and requires no maintenance.

In one modern radiator and grill assembly department, each of six gun-welders join 20 separate parts at 150 places in less than a minute. Gun-welded bonds being stronger, only half as many welds are used.

Other methods of welding—arc, flame, projection, and spot—were previously used. Conventional spot-weld-

TWO ELECTRONIC TUBES (shown in the open cabinet) accurately control the flow of current to the gun-welders. Having no mechanical contacts, no maintenance is required.

JOHNSON *Leaded Bronze* ELECTRIC MOTOR **BEARINGS**

EASY to GET

EASY to INSTALL

Distributors Wanted

If you sell Electrical Supplies, investigate the profit possibilities in Johnson Electric Motor Bearings — no obligation.

● There are more individual types of bearings in the Johnson line than in any other service — over 250. Ample stocks of each number are carried in every principal city — and every bearing is ready for immediate installation. Cast in a special high lead bronze, they deliver the maximum in performance. By any measure of comparison, Johnson offers you the greatest service in Electric Motor Bearings.

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Sleeve BEARING HEADQUARTERS

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WORLD'S FAIR TRANSFORMER INSTALLATIONS

20 page BULLETIN JUST OFF THE PRESS (3 colors)

Shows photos of New York World's Fair Buildings and important transformer installations.

Also illustrates a complete line of transformers for every service.

Plant expansion programs necessitated by National Defense will make these installations and the comprehensive survey of all types of transformers contained in the Bulletin very helpful in selecting transformers for specific jobs.

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THE STANDARD TRANSFORMER CO., WARREN, OHIO

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SOUGHT FOR YEARS BY ELECTRICIANS

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NOW IT IS HERE TO CUT TOGGLE BOLT INSTALLATION TIME 50% AND TO INCREASE YOUR PROFITS

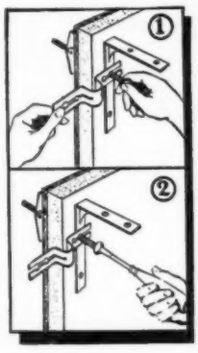
TOGGLE BOLT CLAMP

FITS ALL TOGGLE BOLTS UP TO AND INCLUDING ¼" DIAM.

FREE TO EVERY ELECTRICAL CONTRACTOR

WRITE FOR YOUR CLAMP TODAY

You will save hours of time and take all of the headaches out of every Toggle Bolt installation with this new PAINE Toggle Bolt Clamp. It is made of high quality spring steel with die-sunk recesses on opposite sides of slots providing positive female threading action. You simply follow ordinary Toggle Bolt installation procedure and, when bolt is ready to be tightened, you pull toggle tight against inside of wall, floor or ceiling —slip Clamp over bolt thread flush against bracket or fixture to be anchored, as shown in Fig. 1, and tighten with screw driver, as shown in Fig. 2. Write TODAY, giving name of your Toggle Bolt Supplier, and one of these new PAINE CLAMPS will be mailed to you FREE.



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THE PAINE CO.

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This RIDGID Guarantee Does Cut Your Wrench Costs

Ridgid end wrench for close work. Sizes 6" to 36".

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free.
THE RIDGE TOOL CO. ELYRIA, O.

THIS amazing RIDGID has won world-wide popularity among the most critical pipe wrench users because it really does end all wrench housing repairs and expense. Because the adjusting nut always spins easily to size. Because its safe chrome molybdenum replaceable jaws are instant grip and let-go and the I-beam handle is both powerful and easy on the hand. A tool a man enjoys using—and it saves you money. Buy from your Supply House.

THE RIDGE TOOL CO., ELYRIA, OHIO

RIDGID PIPE TOOLS

GUN WELDERS being used on a radiator and grill assembly consisting of 20 pieces placed in a jig.

ing was particularly troublesome, producing burned spots and poor bonds. Appreciable work had to be repaired. Sometimes burns were so bad that the parts had to be scrapped, especially body parts such as fenders and cowls. Costly shutdowns and heavy maintenance were common due to burned contacting devices.

The gun-welders were designed by engineers of the Progressive Welding Co. The electronic Control was developed by Westinghouse.

Have You Adequate Light?

Foot-candle is the term used for the unit of measurement of illumination. It is the intensity of light at a given point. Average illumination of an area is obtained by averaging the foot-candles at a number of points.

Lumen is the unit of quantity of light. One lumen per square foot equals one foot-candle.

Various levels of illumination, expressed in foot-candles are:

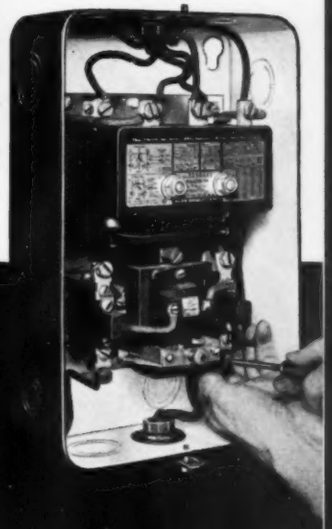
Moonlight	0.02
Well-lighted street (average)	1.0
Well-lighted interior	20–50
Daylight at north window	50–200
Daylight in shade (outdoor)	100–1,000
Direct sunlight	5,000–10,000

So, for consideration: Have you adequate light in the plant? Are you getting all the light from the lamps you should? Have the lighting units been cleaned lately? Are the lamps operated at rated voltage? If the lamps are used at 5 percent under rated voltage, you might save 7.5 percent in watts consumed but you are losing as much as 16 percent in the amount (lumens) of light, and consequently the light intensity (foot-candles) is reduced considerably.

"Look! There is so much room he can practice Alpine climbing!"

Many a starter has been damned because its bulky switch mechanism and small cabinet left no room to do a decent wiring job. Install an Allen-Bradley solenoid starter on your next job and save your temper. The solenoid switch mechanism is so compact that there's plenty of room for wiring. You can do a neat job in a fraction of the time.

But this isn't the only feature that makes Allen-Bradley solenoid starters so popular in all industries. For example, their double break, silver alloy contacts never need cleaning or filing. There are no bearings, pins, or hinges to corrode or stick; no flexible jumpers to break; and no complicated mechanisms to cause trouble. Once they are installed, you can forget about them. For trouble-free control, specify Allen-Bradley.



No Cramped Fingers or Skinned Knuckles When Installing A-B Solenoid Starters

Here's a starter that's designed for easy installation. There's lots of wiring space and plenty of knockouts. The white enameled interior illuminates the starter in dark corners. Terminals are readily accessible. The cabinet cover is completely removable, giving plenty of room to work.

ALLEN-BRADLEY

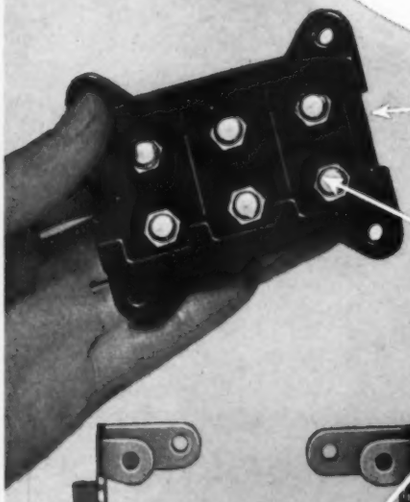
SOLENOID MOTOR CONTROL

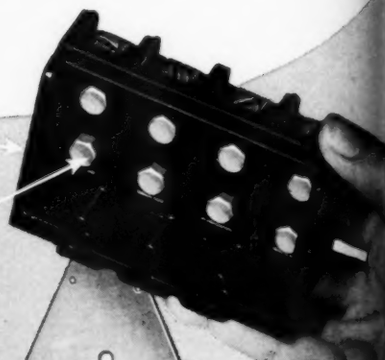
QUALITY

A-B

6 FEATURES that mean long life

in A-B COMBINATION STARTERS





1—Enclosed Arc Hood

Arcs cannot jump outside the arc hood. The combination of arc hood and double-break contacts instantly snuffs the arc. Either of these switches will interrupt at least ten times the maximum horsepower rating of the starter.

2—Double-Break Patented Cadmium Silver Contacts

Contacts will carry current continuously without overheating. They require no cleaning or filing whatever and are always in perfect operating condition.

3—Straight-Line Motion

Contact rebound, the main cause of arcing, burning, and welding, is practically eliminated in these switches.

4—Rapid Action

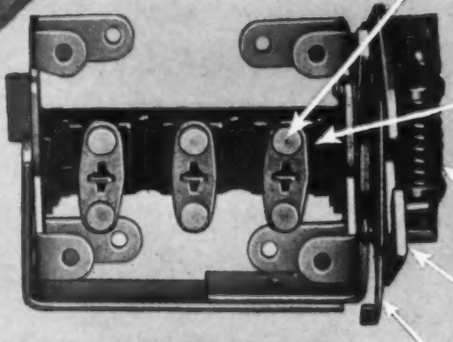
Disconnect and solenoid mechanisms have a quick make-and-break action that greatly reduces contact burning.

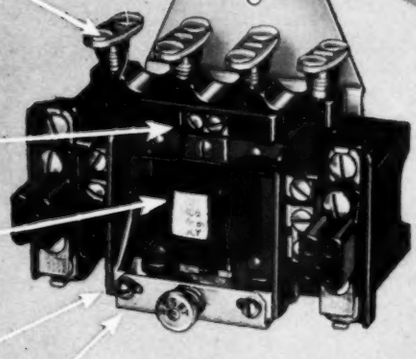
5—Simple Mechanism

No other starter has so few moving and, hence, wearing parts. This is your guarantee of freedom from trouble.

6—Compact Mechanism

The extreme compactness of both magnetic starter and disconnect switch makes possible a very small enclosing cabinet with generous wiring space.





DISCONNECT SWITCH

This new disconnect switch is mechanically operated from the front of the cabinet. Its contact construction is identical to that of the famous Allen-Bradley solenoid starter. The compact mechanism is rugged and trouble-free. The silver alloy contacts will not heat up, no matter how long they remain closed. Also, the current interrupting capacity of this new switch is in excess of ordinary knife-type switches.

SOLENOID STARTER

The second unit in the Bulletin 712 combination starter is the popular Allen-Bradley solenoid starter—proved by actual performance in thousands of plants.

Allen-Bradley Company
1307 S. First St., Milwaukee, Wisconsin

Can Be Locked in its "OFF" Position by Three Separate Padlocks

Cabinet is locked and disconnect switch held in "Off" position with the same lock. Operating lever is so constructed that it can be easily locked in "Off" position by any of three separate padlocks.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

Sawdust and Wiring

Q. *"Can non-metallic sheathed cable or armored cable be used in houses where sawdust is put in the walls for thermal insulation? We passed the Underwriter's rules in this town and have quite a discussion as to this wiring in homes and would appreciate it very much if you could tell me where the above cables can be used. Is sawdust classed as combustible?"*—J.A.K.

A. Section 3369 of the National Electrical Code covers this problem as far as the non-metallic sheathed cable is concerned. As sawdust is most certainly combustible it would not be permissible to use it for thermal insulation in the hollow spaces of walls containing non-metallic sheathed cable or knob-and-tube work (for which see Section 3249). Also, of course, it must not be fished into wall spaces in which sawdust is used for thermal insulation.

With armored cable the situation is different. There are no rules prohibiting the use of armored cable where a combustible thermal insulation is used, except, where the condition would present a dusty hazardous atmosphere.

As stated above, sawdust is combustible. But more than that, finely divided particles of sawdust mixed with air forms an explosive mixture and in a house in which sawdust is used as thermal insulation there might be, at times, such an explosive mixture present in switch and receptacle boxes just waiting for a spark to set it off.

The ordinary run of switch and receptacle boxes are full of slots and holes (one authority has referred to them as sieves) and therefore it would be impossible to keep the sawdust out. It would undoubtedly be best, where sawdust is used for thermal insulation, to use only rigid conduit with explosion proof fittings.

As this is an electrical discussion we will not go into the matters of chemical reactions which may cause carbonization, fermentation, and spontaneous combustion of some kinds of sawdust, but suggest that such things be given careful consideration.

Welding Machines

Q. *"What size 3-phase main feeder and branch feeders should be used to supply power to three 100 KVA, 220-volt, single phase spot welders? On what rule of the Code do you base your recommendations?"*—O.E.P.

A. The Code does not provide for any lower demand factor than 100 per cent for the wiring to transformers. Therefore the circuit wiring should be for the full capacity of the transformer. While the duty cycle of electric welding machines runs all the way from continuous, for the continuous welding, down to a few impulses of a fraction of a second each per minute for spot welders, many of the manufacturers favor using 100 per cent copper capacity for the circuit to the machine.

One large manufacturer gives the following data:—

100 KVA @ 220 volts, single phase, Normal amperes, 445

Recommended fuse size 500 amperes
Recommended wire size 600,000 C.M.

Section 4531 of the Code requires that the transformer be protected by overcurrent devices rated or set at not over 200 per cent of the rating of the transformer. This condition is met in the above recommendations.

But the use of 500 ampere fuses on 600,000 C.M. rubber covered wire cannot be justified. The 1937 Code permits this size wire to be fused with 450 ampere fuses, which, if of the time-lag type, would undoubtedly allow the machine to operate.

But when the 1940 Code becomes effective the 600,000 C.M. Type R wire will have an allowable carrying capacity of 480 amperes only when open wires are used. To then obtain a carrying capacity of 500 amperes for three wires in a conduit in the 600,000 C.M. size it will be necessary to go to the "Asbestos-Varnished Cambric Type AVA" wires. Three 600,000 C.M. Asbestos Varnished Cambric Type AVB wires in a conduit will provide a carrying capacity of 453 amperes each.

BUSY EXECUTIVE R. F. Hornbeck, new president of the T. H. Green Electric Co., progressive contractors and motor repair men of Rochester, N. Y., finds time to answer a few telephone calls. His daily routine keeps him in and out of the office continuously.

The Service Switch

Q. *"In reference to the question as appeared in the October issue, 'Can a 30 ampere 3-wire service switch serve a fuse cabinet with 2-15 ampere lighting and 2-20 ampere appliance circuits.'*

"I do not believe that Section 2357 could be applied here without conflicting with Section 2202 which under certain conditions would permit a 30 ampere switch and the four branch circuits described above, that is,

"I. Residence 25 ft. x 40 ft. = 1000 sq. ft. @ 2 watts per = 2000 watts
2 appliance circuits of 20 amp. each = 20x2x115 = 4600 "
6600 "

6600 ÷ 230 = 28.7 amp. feeders which

These NEW COLT

MANUAL STARTERS
With Automatic Toggle Mechanism

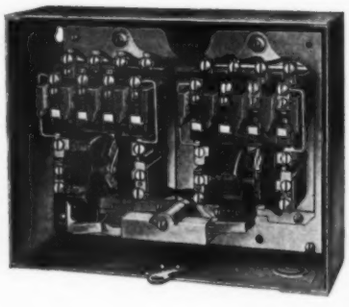
Featuring the ingenious Automatic Relatching Toggle Mechanism — no resetting operation required. Silver to silver contacts — attractive cabinets. Sizes 0 and 1.

CONTACTORS

Exactly like the Magnetic Starters described at the right except that relays are omitted Ball bearing action — silver to silver contacts — handsome cabinets. Sizes 0 and 1

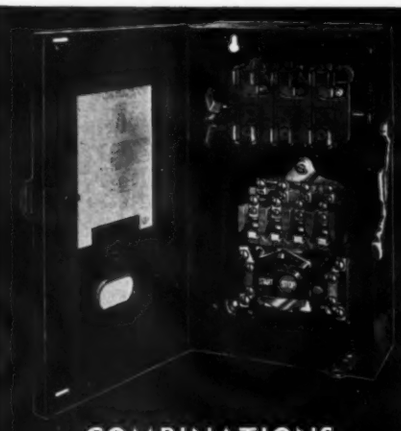
MAGNETIC STARTERS
With Three-Point Ball Bearing Action

Three-point ball bearing action reduces friction to a minimum and flip of reset button changes from hand to automatic operation in a jiffy. Rugged construction throughout. Sizes 0 and 1.



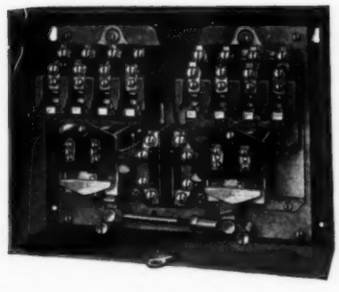
Two-Speed and Reversing MANUAL STARTERS

Across-the-line type of overload protection Automatic latching and mechanical interlock Cabinet provides ample wiring space Sizes 0 and 1



COMBINATIONS

New Colt Magnetic Starters are combined with Type "A" Safety Switches to provide Combination Starters for a wide range of uses. Safety switches have quick make and quick break, interlocking cover.



Two-Speed and Reversing MAGNETIC STARTERS

Equipped with mechanical interlock Entire unit mounted on removable steel back plate Across-the-line type with overload protection Sizes 0 and 1

If You Haven't Placed Your Order For These New Colt Motor Controls - DO IT TODAY!

COLT MOTOR CONTROLS

Manual Motor Starters · Manual Reversing and 2-Speed Starters · Magnetic Contactors and Relays · Magnetic Motor Starters · Magnetic Reversing Contactors and Starters · Magnetic 2-Speed Starters · Combination Starters

MOTOR CONTROLS

..are already Going Places!

They're Built To Do a Job for Industry and for YOU!

Timed perfectly to fit in with present increased industrial activity is this sensational new line of Colt Motor Controls. Industry is demanding equipment that will deliver maximum service — and that's exactly what this new line is built to do.

Motor control equipment is in big demand — and these new units will sell almost on sight. They have selling features galore!

You're missing profits every day you delay in checking up on these new Colt units. Write us today so we can arrange to furnish you with full details.

Complete Bulletins Ready

. . send for copies of Bulletins 404, 504, 501

Manufactured by a World Famous Organization

COLT'S PATENT FIRE ARMS MFG. CO., HARTFORD, CONN.

Electrical Division

Questions on the Code

[FROM PAGE 65]

would require a 30 amp. service. The minimum appliance allowance of 1000 watts has been dropped as the appliance circuits naturally provide for this.

"II. If the 20 ampere circuits were for lighting then we could use the following solution:

"Assume the maximum wattage permissible consumption by the circuits, that is,

2 circuits x 15 I x 115		=	*3450*
2 " x 20 I x 115		=	*4600*
Total wattage			*8050*
First	*2000 @ 100%*	=	*2000 watt*
Additional	*6050 @ 60%*	=	*3630 "*
Appliance min.	*1000 @ 100%*	=	*1000 "*
			6630

" A 30 ampere 230 volt service would permit 6900 watts to be used as a basic figure. Am I correct?"—A.W.W.

A. Notwithstanding the above figuring we fail to see that there is any conflict between Sections 2202 and 2357 and that the Code would permit a service switch smaller than one of 60 amperes capacity under the conditions stated.

In case I above, there are two-15 amp. lighting circuits and 2-20 amp. appliance circuits or on each side of the 3-wire system there would be one 15 ampere and one 20 ampere circuit and 15 + 20 = 35 amperes, while section 2357 says that a 30 ampere service switch shall not be used to supply more than two 15 ampere circuits for which 15 + 15 = 30.

In case II above the use of 20 ampere lighting circuits in a residence is rather improbable. It must be remembered that on these two 20 ampere lighting circuits only heavy duty lamp holders may be used. This precludes the use of medium base lamp holders on fixtures (including portables). Of course there may be some residences which use 20 ampere lighting circuits, but the cases are rare.

So in case II we would have more than the equivalent of two 15 ampere circuits on each side of the three wire system and the 60 ampere service switch would be required not withstanding the fact that the computed load as shown above is not greater than 30 amperes and that #8 service wires (3 #8's) are sufficient.

WHAT IS *Your* Part in the Defense Program?

If the plant is to run smoothly and without interruption, power and light distribution must be as perfect as it is humanly possible to make it. *The electrical system is vital to continuous operation.* Check it in detail—so that emergency may not find it with fatal weaknesses.

Efficient and dependable busducts—switchboards—panelboards—safety switches—and other electrical equipment for power and light distribution should be installed. These should be of ample capacity and of *thoroughly reliable make!*

Nearly fifty years of conscientious development and production place FA Products in a strong position to meet these important requirements. They combine moderate first cost with low up-keep—and they are *made better than necessary.* . . . In new and modernized plants, these FA Products will serve faithfully and well:

Power and Light Distribution Panelboards (Standard and Column Types) . . . Klampswitchfuz Narrow Distribution Panelboards (for floor and wall mounting) . . . Feeder Busducts . . . Plugin Busducts . . . Shutlbrak Safety Switches . . . and many others.

Will the FA Column Type Panelboard fill your requirements better than the Standard Type?

The FA Industrial Column Type Panelboard, with suitable cabinet, is designed to be mounted between the flanges of 8", 9" or 10" H Columns. It may also be used to advantage in any other location where the available space will not accommodate a standard width Panelboard.

These Panelboards are furnished for either single-phase, 3-wire, 115/230 volt solid neutral service, or for 3-phase, 4-wire, 120/208 volt solid neutral service—and are obtainable with 4 to 40 single-pole branch circuits.

Let Our Sales-Engineers Help You

Their long experience is at your service—without obligation, of course . . . And write for *New* Catalog No. 56 and Bulletin No. 60 . . . Frank Adam Electric Company, St. Louis, Mo.

ESTD 1891 THE SIGN OF A BETTER JOB
FA
Frank Adam
ELECTRICAL PRODUCTS
for Industry
FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

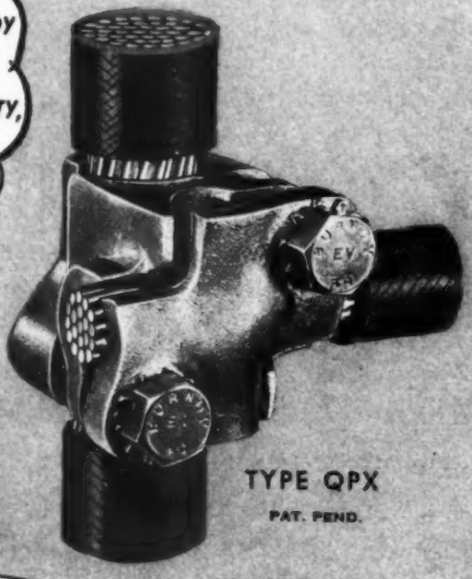
INTRODUCING THE

VERSITAP

ONE CONNECTOR

FOR USE AS A TEE, LINK, CROSS OR PARALLEL CLAMP...TAKES WIDE RANGE

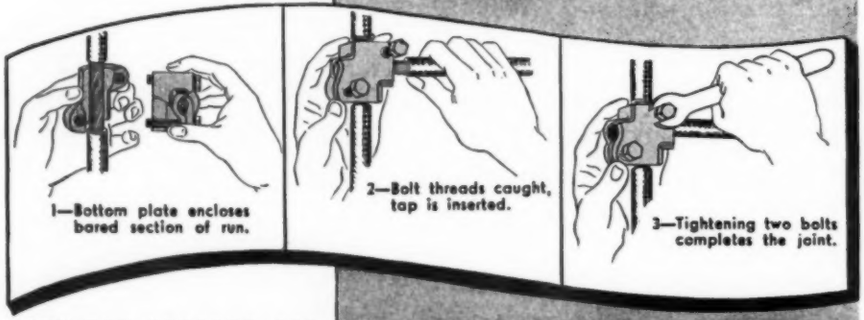
AT LAST SOMEBODY WORKED IT OUT... HIGH ADAPTABILITY, LOW PRICE!



TYPE QPX

PAT. PEND.

Keeps connector stocks small . . . Installed with a wrench, compact . . . Prevents cable bending on offset taps . . . High strength, conductivity copper alloy . . . Ten sizes cover any of 814 joints.



1—Bottom plate encloses bared section of run.

2—Bolt threads caught, tap is inserted.

3—Tightening two bolts completes the joint.

HAVE YOU CATALOG 41?

—for copies write to

BURNDY ENGINEERING CO., INC.

459 East 133rd Street, New York City.

A SINGLE VERSITAP HANDLES THESE CONDUCTOR SETUPS

SEE YOUR WHOLESALER ABOUT

BURNDY CONNECTORS

Stepping Out With Instruments

[FROM PAGE 14]

be in need of repair. These conditions were corrected by exchanging motors on machines, raising power factor, and improving operation.

A very interesting incident occurred during this survey. All tests were run continuously for twenty-four hours of the day to get accurate time and cycle of operation. Our chart showed a periodic load at regular intervals during the night when the plant was not in operation. We traced this to the water pump motor which should normally have been off during the night. A check-up revealed a bursted pipe which permitted the loss of water and of course the extra power used.

It is of course true that this one instrument cannot give accurate results as to power factor and kw., but, in the great majority of cases, with the results that one can obtain from the ammeter reading, these figures can be approximated closely enough for all practical purposes as in the test described.

The ease with which this instrument can be transported, attached, and used, especially in conjunction with the split-core clamp-on transformer, which permits connecting the ammeter to a circuit without the necessity of stopping equipment and breaking the line, enables most anyone to use the equipment with accurate results.

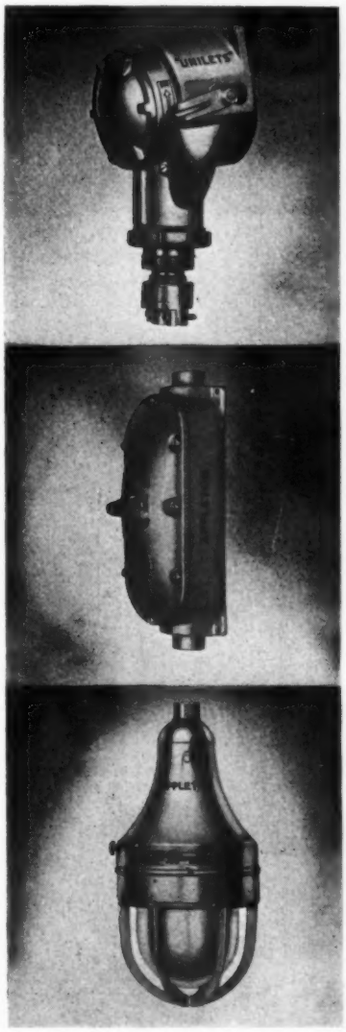
The instrument has a dual current range of 1¼ and 5 amps. which makes it convenient to use on both low and high current. By using a 100 watt lamp in series with the 1¼ ampere coil and connecting to the line one can secure a relative check on voltage fluctuation. Actually this is not a very accurate voltage indication but by comparing the record with an indicating voltmeter we are able to get a good indication of voltage conditions. By this method we can easily detect fluctuations of three to four volts on a 110 volt circuit.

We have used this hook-up on several occasions to detect overloaded lighting and power circuits. As mentioned this test is not absolutely accurate, and has been used only in lieu of a recording voltmeter which is next on our list, together with several split-core transformers of various ratings to extend the range of the instrument.

We feel that this one instrument alone has done more for us in the way of securing additional business and enhancing our reputation than anything else we could have purchased.

Make more money with APPLETON

APPLETON ELECTRIC PRODUCTS
REG. U. S. PAT. OFF.



Our complete line helps you to standardize all your installations and promotes speedier completion of jobs and bigger NET profits.

Right now hundreds of plants are stepping up production, making extensions, erecting new buildings, putting on extra shifts to meet the zooming demand created through the spending of Billions of Dollars by our Army and Navy for NATIONAL DEFENSE.

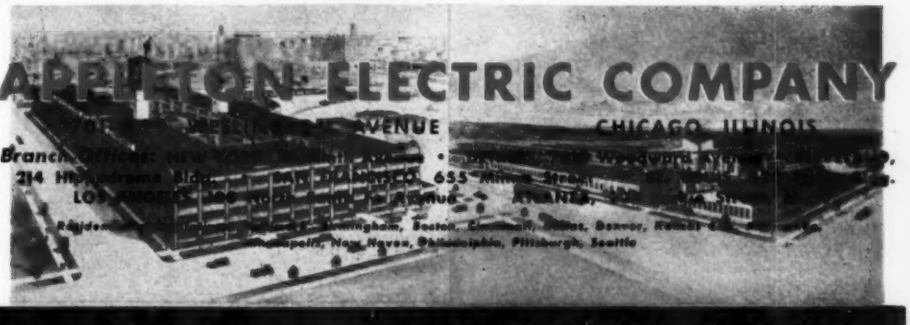
This process multiplies manyfold the number of HAZARDOUS LOCATIONS where

APPLETON EXPLOSION PROOF FITTINGS

are the *complete* answer.

A *complete line* of SEAL-LINE UNILETS, SWITCH UNILETS, LIGHTING FIXTURES, and *complete* factory stocks have put the APPLETON distributor in the spotlight as headquarters for EXPLOSION PROOF FITTINGS, and he can give you quick service.

Write for catalogs with complete details and the name of your nearest Appleton Distributor.



Conduit Fittings · Outlet and Switch Boxes · Explosion Proof Fittings · Reelites

In the News

ALEA HOLDS CONFERENCE

The American Lighting Equipment Association held an Educational Conference August 15–16 at the General Electric Institute, Nela Park. The meeting marked a new high in residential lighting fixture industry conferences and served as a springboard for the newly-adopted ALEA Specification-Certification Program, which has as its goal the raising of industry standards, improvement of overhead lighting practice and the increase of the residential fixture market with the attendant benefits to utilities, wiring interests and mazda lamp manufacturers. All fixtures conforming to the I. E. S. performance standards for residential fixtures and meeting with the design approval of ALEA will be certified by the Electrical Testing Laboratories and carry the ALEA Certification tag.

The two day conference, under the chairmanship of J. Markel, ALEA president, brought together 78 representatives of Association members' organizations, utilities, electrical wholesalers and dealers and others interested in the design and distribution of residential lighting fixtures. The program featured outstanding authorities in the fields of lighting, merchandising, design and decoration; Association officers, utility executives and department heads of the mazda lamp manufacturers.

FARGO ADOPTS ELECTRICAL ORDINANCE

An electrical ordinance setting up National Electrical Code provisions as a standard has been adopted and is now in effect in the city of Fargo, North Dakota. In addition to the National Code rules several added local requirements are included. Standard weight conduit is required for all new service entrances and for connecting outside signs.

Master electricians must pay a fee of $100 upon application and $50 a year. Journeymen electricians must hold a license and pay a fee of $2 for the first year and $1 each year thereafter. In order to obtain a city license the master electrician applicant must have a place of business in the commercial district of the city of Fargo.

The ordinance also provides for inspection. Frank S. Johnson of the J. & L. Electric Co. has accepted the position of inspector and will take up his duties at once.

HOGUE HEADS CHICAGO LIGHTING INSTITUTE

Oliver R. Hogue, manager of lighting and wiring sales of the Commonwealth Edison Company, was elected president of the Chicago Lighting Institute on August 12 to fill the vacancy caused by the death of E. W. Lloyd.

Other officers elected at this meeting include secretary-treasurer, Ralph G. Raymond and assistant secretary-treasurer, G. K. Hardacre. John G. Learned continues as vice-president of the Lighting Institute.

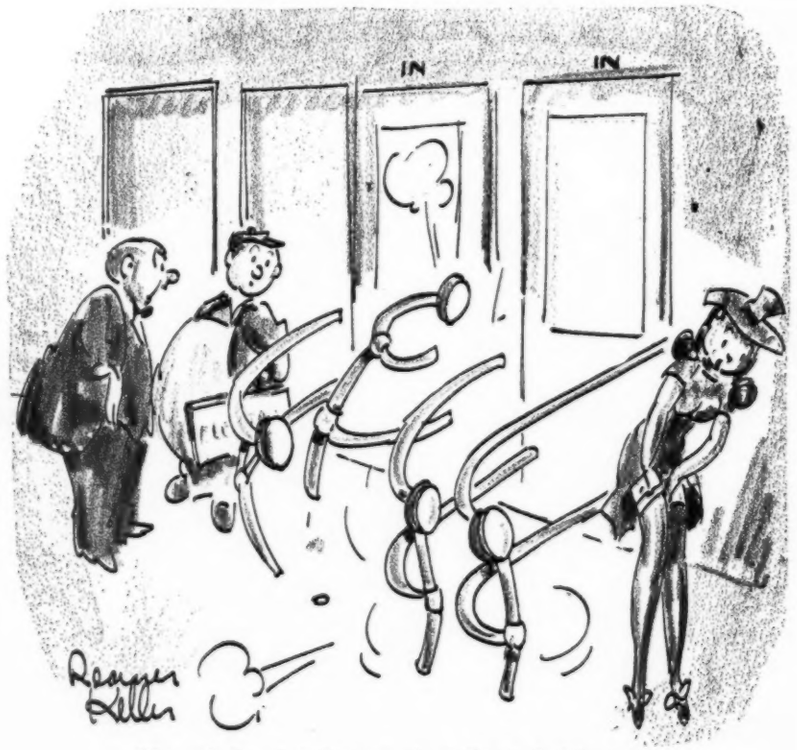
Mr. Hogue, a former director of the Illuminating Engineering Society, has served the Chicago Lighting Institute as secretary-treasurer since its establishment in 1930 and has also been chairman of the committee on management. He is a veteran leader in the field of lighting development having entered the employ of the old Chicago Edison Company in 1896.

The Chicago Lighting Institute is an enterprise devoted to the advancement of the technique of lighting sponsored by the Benjamin Electric Manufacturing Co., Commonwealth Edison Co., Curtis Lighting, Inc., The Electric Association of Chicago, General Electric Co., Public Service Co. of Northern Illinois, and Westinghouse Electric & Mfg. Co.

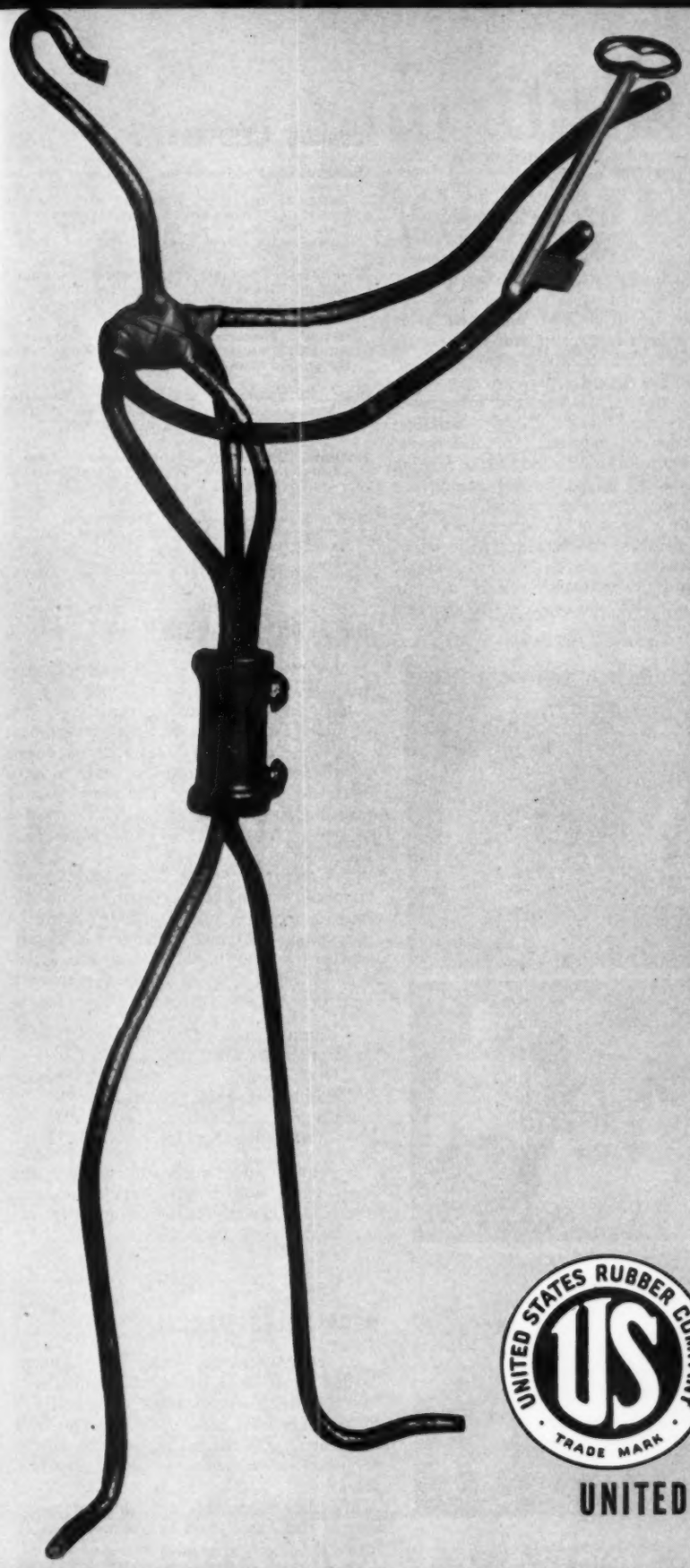
CONTRACTORS ADVERTISE ADEQUATE WIRING

Forty-six electrical contractors in nineteen communities of the Inland Empire are actively engaged in what is perhaps the most remarkable example of cooperative advertising on adequate wiring to be found in the nation.

The program is directed by the Spokane Adequate Wiring Bureau, with the cooperation of the Washington Water Power Company. The contractors have taken generous amounts of advertising space in their home-town newspapers to tell the folks about certified adequate wiring and congratulate home-owners who received the A. W. certificate. In addition to the electrical contractors,



"See, that's what I mean about these electric eyes!"



HERE'S A NEW KEY TO THE COMMERCIAL REWIRING MARKET

Smaller in over-all diameter—protected with a new-type fibrous covering that is uniformly symmetrical—U. S. Rubber Laytex* "Dilec" branded building wire brings you an entirely new opportunity to cash in on the national demand for increased capacity in existing electrical conduits!

This unique combination of Laytex* and "Dilec," with the new and novel fibrous covering is Safecote *plus*—free skinning, fishable, flame-retarding, and moisture-resisting.

And for your assurance of highest standards of wire manufacture, look for the U. S. Rubber name, type of wire, voltage and size clearly branded on each length of wire! Why not get in touch with your U. S. Rubber Wire distributor today? There is one near you!

You Cannot Buy A Smaller Diameter Wire Than U. S. Laytex "Dilec"*

UNITED STATES RUBBER COMPANY · US · TRADE MARK ·

Laytex* DILEC

UNITED STATES RUBBER COMPANY

Rockefeller Center, New York

NOTHING INSULATES LIKE RUBBER...

U. S. Laytex* IS RUBBER INSULATION AT ITS BEST

*REG. U. S. PAT. OFF.

[FROM PAGE 72]

eight electrical supply companies, seven lumber and building material dealers, four appliance dealers, six builders, two banks and one hardware dealer advertised at the same time to complete an all-industry tie-in for the benefit of the prospective home builder.

AIR CONDITIONING SURVEY

The Edison Electric Institute has released the 1940 survey of air conditioning installations, by business classifications, in the United States. There were 42,604 installations reported which used a total of 873,024 horsepower. The 183 utility companies represented in the survey serve 75,000,000 people.

One-fourth of all these installations are in offices and office buildings, one-fifth in restaurants and retail stores, one-fifth in apartments, and the remainder scattered among nearly 24 different commercial and industrial classifications.

In the industrial field, the food processing industries group ranks first in the number of installations; candy manufacturing is second; fur storage establishments third; printing and lithographing plants are fourth. Candy manufacturing leads all industries in total horsepower with printing and lithographing plants ranking second in this respect.

The report also showed that the average doctor's or dentist's office uses only two horsepower; the average public building installation requires 142 hp. and air conditioned department stores use an average of 109 horsepower to operate their equipment.

HIBBING SNAPSHOTS—In far north Hibbing, on the Mesaba iron range in Minnesota, the Minnesota Electrical Council and Minnesota Electrical Association held their annual summer meeting, went sightseeing, dined and danced. (1) An interested group watching ore loading in the Oliver Iron Mine. (2) Ed Karst of Fergus Falls and Jerry Tripp, Minneapolis. (3) Arthur H. Brayton, Des Moines, and Al Kessler of the North Central Associated Electrical Industries. (4) Ed Micka, Hibbing, secretary-manager William A. Ritt, St. Peter and Council president, Sam Newstone. (5) Registration badges were in charge of Marie E. Schnabel and Charles Stephenson of the Council offices. Lou Gordon of Albert Lea is being signed in. (6) President and Mrs. Charles Wood of the North Dakota Electrical Contractors Association.

COMING MEETINGS

International Association of Electrical Inspectors — Northwestern Section, Great Falls, Mont., Sept. 3-6. Southern Section, Houston, Texas, Sept. 16–20. Western Section, Kansas City, Mo., Sept. 23–27; Eastern Section, New York, N. Y., Oct. 7–11.

New Jersey Council of Electrical Leagues—Annual Convention, Hotel Traymore, Atlantic City, N. J., Oct. 5.

National Electrical Contractors Assn.—Annual Convention, George Washington Hotel, Jacksonville, Fla., Oct. 21–23.

National Electrical Wholesalers Association—Semi-Annual Convention, Hotel William Penn, Pittsburgh, Pa., Oct. 22–25.

National Electrical Manufacturers Assn.—Annual Conference, Waldorf-Astoria Hotel, New York, N. Y., Oct. 27 to Nov. 1.

North Dakota Electrical Contractors' Association—Annual Meeting, Fargo, N. D., Nov. 15–17.

DATA ON PERSONNEL

A survey embracing 750 electrical contractors about the country has just developed some interesting statistics. The purpose was to provide the government with some evidence of the type and extent of the staff equipment of the modern electrical contractor. The survey was made by the NECA Statistical Committee of which A. Lincoln Bush of New York was chairman.

The report of these 750 electrical contractors showing their organizations, resources, experience and capacity, shows an impressive personnel available for electrical construction in the preparedness program. These 750 contractors employ a total of

Engineers	1,140
Estimators	1,380
Draftsmen	816
Purchasing Staff	804
Clerks	1,932
Construction Supts.	1,272

No effort was made to number the journeymen and helpers employed since this is a constantly changing quantity owing to the work in hand.

NECA SALES MANUAL

A committee on sales development headed by D. B. Clayton of Birmingham, has begun the publication of a NECA Manual of Sales Development. The first installment was out in August. It will be published from now on as a monthly service.

The plan is to make available for members of the Association in a simple, usable form, the basic principles on how to sell, where to sell and what to sell. This will take up the psychology and principles of selling in terms of advertising and engineering the sale. It is intended to gradually build up a textbook on the electrical contractor's market opportunity and what to do about it, which can be filed in a leather cover and made of practical use.

Your *Unlisted* ASSETS

EVERY CONTRACTOR has them. They never show on your books. Without them, you could hardly stay in business. Being hidden in the structure of your business, they are apt to be overlooked. Nobody but *you* can really figure their value to you. How about trying:

Item 1 Enter here your estimate of the cost of the extra floor space you would need to store all the electrical supplies your Wholesaler stores for you, without charge, in *his warehouse*..... $_____

Item 2 Next add the value of having your electrical supplies delivered by your Wholesaler without transportation costs direct on the job, or to your own place..... $_____

Item 3 Add the value of being able to buy dozens of separate supplies from a single Wholesaler instead of ordering same from dozens of different manufacturers..... $_____

Item 4 Add the value of fast Wholesaler service and deliveries as against manufacturers' inability to match any such speed and service..... $_____

Item 5 Finally put down the value of having your Wholesaler estimate costs for you, bring you reliable facts on new electrical items and act as your Purchasing Agent ..... $_____

TOTAL, AS IT ADDS UP TO YOU... $_____

IF your Wholesaler is a T & B Distributor, you are doubly fortunate: His is a genuine service organization. One that takes a constant personal interest in your business welfare and success. One that understands your long-range problems. One that helps you build up your "Unlisted Assets" day by day, year by year.

THE THOMAS AND BETTS CO., INC.

MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

Factory, Engineering and Executive Offices, Elizabeth, N. J. • Sales and Service offices in 23 leading cities

T & B Distributors cover United States and Canada

RUBBER COVERED POWER CABLES • BUILDING WIRE • VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

5 REASONS WHY YOU SHOULD BUY CRESCENT GENUINE A.B.C. Armored Bushed Cable

1 CONDUCTORS—Clean stripping insulation and flame retarding covering, printed as shown.

2 BUSHING—easy to insert as paper unwraps from *under both ends* of armor to make room for the bushing.

3 STEEL ARMOR—low resistance, electro-galvanized for maximum uniformity and longest life.

4 TESTED—Thoroughly tested at several points during manufacture and receiving a final test of 2000 volts between conductors and armor.

5 *CRESCENT has unexcelled facilities for the complete manufacture of Armored Bushed Cable in all its steps. When you buy CRESCENT A.B.C. ARMORED BUSHED CABLE you buy the best. Do not be satisfied with any substitute.*

CRESCENT INSULATED WIRE & CABLE CO. INC
TRENTON, NEW JERSEY

Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland
Detroit Indianapolis Kansas City Los Angeles Minneapolis
New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

CRESCENT ENDURITE SUPER - AGING INSULATION

In the News

[FROM PAGE 74]

UNDERWRITERS' LABEL SMALL DIAMETER WIRE

Underwriters' Laboratories last month extended label service to the eleven manufacturers making heat resistant grade type RHT, sixteen making performance grade type RPT, four making latex grade type RU and thirteen manufacturing synthetic type SN, insulated small diameter wires.

The new labels distinguish between the types of small diameter conductors by designating the grade and by the color of the label. Heat resistant grade labels are printed on a blue background; performance grade, orange background; latex grade, green background; and synthetic insulation, yellow background.

SODIUM LIGHTING FOR HIGHWAY INTERSECTION

Wisconsin's first highway lighting project will soon be announced. The intersection of the Milwaukee-Plymouth-Greenbay Roads under the proposed plan will be illuminated with 59 sodium vapor lighting units.

The project will include 15,300 ft. of No. 8, 5,000 volt conductors and 13,900 ft. of trenching. The lighting system will be operated automatically by a photo-electric control.

COST OF ELECTRICAL CONSTRUCTION

J. W. Collins and Ray Ashley of the Electrical Contractors Association of Chicago have recently developed some comparative figures on the relative costs of

BOOSTERS for the Western Section IAEI meeting in Kansas City Sept. 23 to 25, plan entertainment for the special train which will carry members from Chicago, and those who will travel by way of the Midwest metropolis, in streamlined comfort to the convention city. Chairman Samuel R. Todd (left) and Chicago committeeman Ray Stewart (right) consult A. A. Gray, of the Chicago Electric Association

TWENTIETH 1920 ANNIVERSARY 1940

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20 years of — PIONEERING RESULTS...

Offering the industry an ALL BAKELITE DUPLEX FLUSH RECEPTACLE that is as near to Perfection as it is humanly possible to produce.

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Rated 15A—125V 10A—250V

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A Few of the Outstanding Features

- New improved pressure contacts.
- Exceptionally wide ears.
- Heavy terminal screws with large heads.
- Heavy solid all bakelite front and back.
- Compact—tapered ends.
- Shallow construction.
- Easy finding slots.
- Modern design.
- Available in both Brown and Ivory.

"PERFECTION IS NOT AN ACCIDENT"

Our Distributor will be pleased to serve you.

EAGLE ELECTRIC MFG. CO., INC.

BROOKLYN

N. Y., U. S. A.

TO THE CONTRACTOR WHO NEEDS TO CUT HIS COSTS

GREENLEE Hydraulic Benders Can Save You 15 to 75% On Bending Costs

To bend conduit requires power . . . approximately 31 tons for 4-inch conduit . . . and the Greenlee Hydraulic Benders have power —40 tons of easily developed power in the No. 775 Bender and 25 tons in the No. 770 Bender. This power makes bending so fast and easy for the man on the job that you can save enough on labor costs alone on the first few jobs to more than pay for the bender. Many contractors have said that the Greenlee Bender has lowered labor and material costs anywhere from 15 to 75%. Write for more information and Catalog 31E.

The Greenlee No. 770 Bender shown above has a maximum pressure of 25-tons for bending conduit from 1¼ to 3-inch size. For bending the larger 3 to 4½-inch conduit, requiring more power, the No. 775 Bender has a maximum pressure of 40-tons. Built compactly into one unit, these benders are easily carried to the job and set up and will not move and twist about when in use. An electric power unit can easily be attached.

NOW A BUS-BAR BENDER!

The Greenlee Hydraulic Bus-Bar Bender, now ready for the power utilities and electrical contractors, has been developed to bend, easily and quickly, bus bars up to 4" wide and ¾" thick, and to make U-bends with a minimum inside width of 3½ inches. The bus-bar bending attachment can be purchased separately to be used on the regular Greenlee No. 770 Power Unit or as a complete machine with power unit and attachment together.

Write for More Information Today!

GREENLEE TOOL CO.

1708 COLUMBIA AVENUE ROCKFORD ILLINOIS

In the News

[FROM PAGE 76]

various types of electrical wiring. They have been published by the Estimating and Cost Data Committee of the National Electrical Contractors Association as a guide.

Based on a survey of existing costs in various communities, the following recommended percentages are suggested as a safe basis of comparison—

Non-Metallic Sheath Cable	100%
Knob and Tube	110%
Armored Cable	120%
Metallic Tubing	150%
Rigid Conduit	170%

EASY PAY FOR FACTORIES

The General Electric Contracts Corporation has made available to customers of General Electric agents, distributors and dealers, a new convenient and simple time payment plan with liberal terms and low rates.

The plan, available on a nation-wide basis through the many offices of the GECC, is designed to assist industries and businesses in the purchase of needed equipment for modernization and expansion. Because of its flexibility it can be made to meet the requirements of almost any concern and it is expected that it will enable the user, in many cases, to pay for the equipment out of additional earnings brought about by modernization.

CHICAGO LIGHTING INSTITUTE REMODELED

To permit the demonstration of up-to-date lighting equipment under the actual conditions encountered in commercial lighting problems, the Chicago Lighting Institute has just completed the renovation of its commercial lighting laboratory in the Civic Opera Building in Chicago. Lighting equipment is displayed against exact replicas of displays found in typical retail stores.

Adjoining the commercial laboratory is the new fluorescent lighting clinic devoted entirely to demonstration of fluorescent light development for commercial and industrial application. Among the striking displays of fluorescent lighting technique is a 15-ft. by 15-ft. luminous ceiling providing 80 footcandles of daylight illumination.

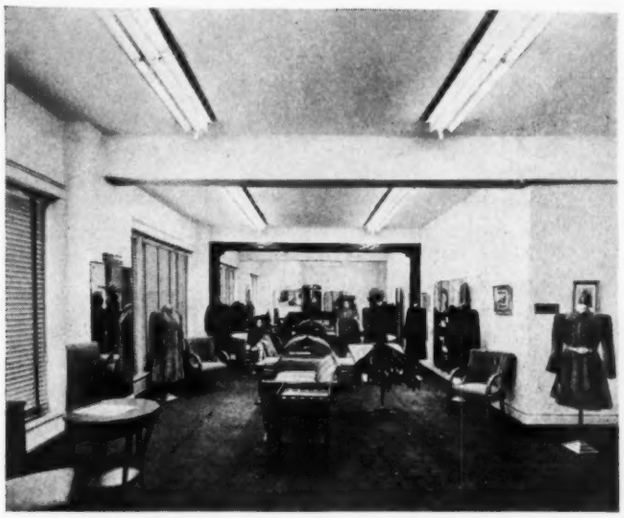
BOOK REVIEW

Lessons in Arc Welding

This book contains a series of 51 lessons in arc welding. It forms the basis of instruction in the Lincoln Arc Welding School and is based on the experiences of Arthur Madison, instructor in this course. Presents in a concise manner, the fundamental facts of welding and contains a wealth of comprehensive practical information that will be

MORE SALES—QUICKER SALES WITH *SkyLux* LUMINAIRES

In Coca-Cola Bottling Co., Milwaukee office, accountants operate bookkeeping machines easier with SkyLux lighting.



Alper and Sulak, Chicago, finds daylight SkyLux fluorescent lighting reveals color-matching and quality of furs.

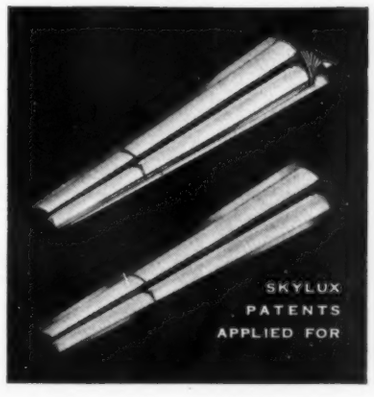
Hudson-Belk Store, Raleigh, N. C., uses SkyLux equipment and has top-notch lighting for department store selling.

F. W. Dodge, Chicago, derives real benefits in terms of accuracy and speed from SkyLux illumination.

SKYLUX LUMINAIRES FOR *Fluorescent* GENERAL LIGHTING

Striking and attractive in shape and finish, designed for high light output, and available in any desired length. A twin *SkyLux* unit uses two 40-watt fluorescent lamps; a single *SkyLux* unit uses one 40-watt fluorescent lamp.

SkyLux units can be used as complete 48″ fixtures or coupled together into continuous lines. If, after an initial *SkyLux* installation is made, higher lighting levels are desired, new units can be added on to existing ones—this is the *Plan-A-Line* feature of the *SkyLux* design.



FOR COMPLETE CATALOG INFORMATION ON SKYLUX, PLEASE WRITE

Curtis Lighting **1123 W. JACKSON BLVD. CHICAGO**

FOUR POINT ECONOMY—

Above: Type CFT, three-phase, outdoor-type, air-cooled, general-purpose transformer.

Below: Type CF, Single-phase, outdoor-type, air-cooled, general - purpose transformer.

1 LOW INITIAL INVESTMENT

2 EASY TO INSTALL

3 MINIMUM MAINTENANCE

4 EFFICIENT IN OPERATION

Whenever it is desired to obtain a low-voltage supply from a higher voltage circuit you will find AmerTran Type "CF" Air-Cooled Transformers both economical and convenient to use. These moderately priced units may be installed wherever they are needed—either outdoors or indoors*—without the necessity of oil, fire-proof vaults or enclosures. All sizes are equipped with either conduit fittings or a built-in junction box to facilitate installation, and both single-phase and polyphase types are furnished as a single unit. Available in capacities up to 100 Kva. and for potentials up to 2400 volts, all ratings offer low initial investment, minimum installation and maintenance expense, and low operating cost. Let us send data on equipment to meet your needs. Ask for bulletin 1116A.

* Units rated 15 Kva. and larger for indoor service only.

Type "CF" Applications

1. Stepping down power circuit voltage to 115/230 volts for lights, small motors or heating elements. In this way advantage may be taken of lower power rates for low-voltage loads.
2. Obtaining a 3-wire circuit from a 2-wire system.
3. Changing from 3 phase to 2 phase, or vice versa, on a power system.
4. Obtaining low voltage for heating, welding, 32-volt tools, special lighting, testing, etc.
5. Balancing load on 3-phase systems.
6. Insulating one circuit from another.
7. Distributing power at 600 volts or less.
8. Reducing light flicker.
9. Obtaining special voltages to permit efficient operation of equipment.

AMERICAN TRANSFORMER COMPANY

178 Emmet St. Newark, N. J.

PRODUCTS

American Transformer Co. manufactures transformers for every industrial, electronic and laboratory application in sizes up to 10,000 Kva and for potentials up to 132 Kv. Other products: voltage regulators, test sets, rectifiers.

AMERTRAN TRANSFORMERS

Manufactured Since 1901 at Newark, N. J.

In the News

[FROM PAGE 78]

helpful to beginners as well as experienced welders and others seeking a ready reference to fundamental information on arc welding and its proper application.

The book is divided into four principal sections covering: Welding with Unshielded Arc Electrodes—19 lessons; Welding with Shielded Arc Electrodes—9 lessons; Electrodes for Particular Joints and Metals—15 lessons; Hardfacing—8 lessons. The text explanations are graphically supplemented by line drawings and photographs for ease of understanding. Questions on each of the lessons enable the reader to check his knowledge. Lessons in Arc Welding. 144 pages. Over 100 illustrations. Semi-flexible simulated leather bound. Price 50 cents in U. S. A., 75 cents elsewhere. Published by the Lincoln Electric Company, Cleveland, Ohio.

—WITH THE— Manufacturers

Allis-Chalmers Manufacturing Co. has appointed F. J. Geiger as assistant manager of the Electrical Department, in charge of sales and engineering at its Norwood, Ohio, plant.

Frank R. Freyler, now in the Philadelphia office, will be transferred to the Norwood plant to take over Mr. Geiger's former duties as assistant manager of sales.

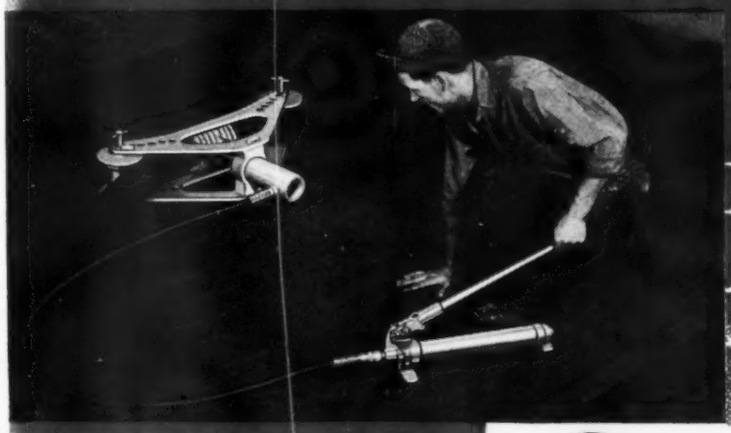
E. C. George, who has been acting as works manager of the Norwood plant and A. Thorsen, who has been acting as assistant works manager, have both been officially appointed to those respective positions.

•

Cutler-Hammer, Inc., has appointed R. Volbrecht to its New York merchandising sales staff. He was formerly in the Philadelphia district office.

"NO BOSSES in this shop", says Paul T. Bonham of Tri State Armature & Electric Works in Memphis, "and none needed. Any of our men are competent to take full responsibility for any of our work." And that liberal policy, backed up by one of the best equipped shops in the Mid-South, is proved by the quality of work turned out.

NEW . . . DEPENDABLE . . . BEND 7 SIZES OF PIPE WITH



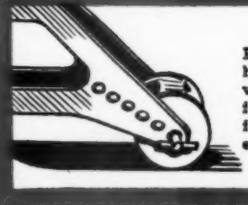
S-36

BLACKHAWK Porto-Power

Exclusive NEW FEATURES

"Pull-Pins" with "Lock-On" fittings hold Pivot Shoes in Bending Frames of S-30A and S-36. Easily removed and inserted. No nuts, bolts — no wrenches.

Bending Frames of S-30A and S-36 are heavy steel plate welded to a ram collar — making one-piece assembly and eliminating separate extension bars. No jack-knifing. Speedy assembly!



Pivot Shoes on S-36 have extra-wide rims which serve as wheels for rolling unit along floor. No carrying necessary while on job.

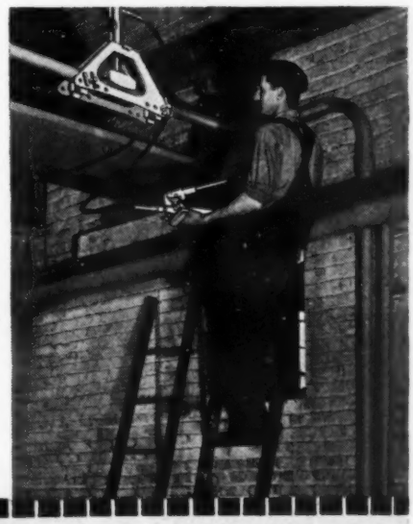
This new, low-cost, super-range Blackhawk S-36 Porto-Power Bender handles 7 sizes of pipe — 1¼" to 4"! Pays for itself in savings of time — provides speedy set-ups — is light in weight — rolls to the job — and is powered by Blackhawk's famous 20-ton all-directional *hydraulic* remotely controlled Porto-Power ram. *Porto-Power Hydraulic Units are DEPENDABLE, as service-proved through years of maintenance-free performance in many other applications.* Ram retracts automatically at finger-turn of release valve for quick re-positioning of pipe. Also used with special attachments for pulling pulleys, gears, etc., and for wide range of press, push and lift jobs in construction and maintenance.

A Product of

BLACKHAWK MFG. CO., Dept. 20119, Milwaukee, Wisconsin

S-30A HANDLES 4 SIZES

The new S-30A Porto-Power Bender has practically all features of larger S-36 — but includes 10-ton instead of 20-ton hydraulic unit. Handles 1", 1¼", 1½" and 2" diameter pipe and rigid conduit. All-directional, remotely controlled ram permits use on ladders, scaffolds and in cramped quarters. Costs only $97.25 — slightly higher on West Coast and in Canada.



Order S-36 or S-30A from your Industrial Supply House TODAY — or send coupon for catalog and prices.

SOLD THROUGH ESTABLISHED INDUSTRIAL SUPPLY HOUSES

BLACKHAWK

BLACKHAWK MFG. CO., Dept. P2090, Milwaukee, Wis.

RUSH new Pipe Bender Catalog and prices also name of nearby distributors.

Name.....

Company.....

Address.....

THERE'S ONLY ONE WAY TO DO THIS JOB RIGHT!

USE KESTER ROSIN-CORE SOLDER

For more than forty years contractors have relied on Kester Solders to save time and money on every type of work where soldering is a factor.

When you specify Kester Rosin-Core Solder for all electrical work you can be sure that the connections will be *permanent*. This is the famous solder with the special rosin-flux self-contained in the core. This flux eliminates corrosion and reduces the fire hazards.

Kester Solders are made of highest quality virgin metals in a wide variety of alloys, fluxes, strand and core-sizes. Your jobber will supply you with the right Kester Solder for every job you have to do.

KESTER SOLDER COMPANY

4208 Wrightwood Avenue Chicago, Illinois

Eastern Plant: Newark, N. J.

Canadian Plant: Brantford, Ont.

KESTER

ROSIN-CORE SOLDER

STANDARD FOR ELECTRICAL WORK

In the News

[FROM PAGE 80]

John A. Roebling's Sons Company of Trenton, N. J., announces the creation of a new Export Division to be located at 19 Rector Street, New York City. William P. Laseter has been made manager of this Division.

Robert A. Hill has been appointed branch manager of the Southwest territory, with offices in Houston, Texas.

•

Pittsburgh Reflector Company announces the appointment of Charles H. Goddard as general sales manager. He was formerly New York branch manager, and will continue to make his headquarters at 1775 Broadway, New York City.

•

General Electric Co. has named G. G. Bobst a lighting specialist for the company with headquarters in Syracuse, N. Y. Mr. Bobst will cover the territory east from Syracuse as far as Albany, north to the Canadian border and south to Binghamton, N. Y.

•

The Frankelite Co., Cleveland, Ohio, announces the appointment of Max H. Perkoff as sales manager of its Lighting Division. He succeeds A. A. Grogan.

•

Airtemp Division, Chrysler Corp., announces the appointment of Ward H. Barnett as merchandising manager.

X-RAY SIDELINE—George Williams, of Superior Electric Service Co., Springfield, Mass., motor repair shop, inspects the tube of an X-Ray machine, which is in the shop for repairs. This proves to be "plus" business for his company and the quick service pleased the local doctors whose apparatus came in for an overhauling.

Six weeks ago he said to us

"What? **Me** Sell Private Telephones?"

Jack Jones thought we were crazy when we suggested that he take on the Automatic Electric line of private interior telephone systems. He said "I don't know a thing about telephones. And even if I did, they're out of my line."

We told him that he didn't have to know anything about them—that he could be selling telephone systems just as easily as transformers, lighting fixtures, or base plugs—and that folks looked to him as the logical supplier of intercommunication equipment. And we added that if he needed any help he should just whisper and we'd come running.

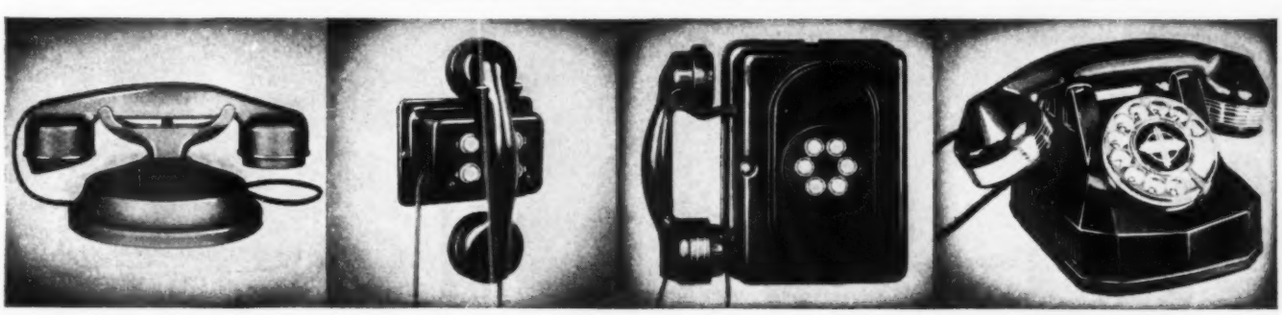
Our story seemed to make sense, so he gave in and said he'd give 'em a whirl and see what happened.

Well, in words of one syllable, he went to town!

and NOW he says-

"I've really been doing a nice business in telephones since I took on the Automatic Electric line—yet I've hardly started; and my customers are just as happy about their purchases as I am. This extra business is certainly welcome. Thanks a million for putting me wise!"

Four of the many types of Automatic Electric intercommunicating systems available are shown here. All are designed for private service. They are not intended to be connected with the public telephone system. For complete information and prices on private interior telephone systems and accessories see your local electrical wholesaler.



SERV-U-FONES

Low priced, all metal telephones, in common talking systems of two to ten stations. Conveniently packaged and simple to install.

IDEALFONES

Wall type with molded handsets. Offered with one or five buttons for common talking service up to ten stations.

INTERCOMS

Supplied in both desk and wall styles—with molded plastic handsets. Common talking systems of two to eleven stations.

P-A-X's

Private automatic exchange systems, providing dial service and secret connections, from ten stations up. Telephones in a variety of types.

AUTOMATIC ELECTRIC

PRIVATE INTERIOR TELEPHONE SYSTEMS

Distributed by: AMERICAN AUTOMATIC ELECTRIC SALES COMPANY, 1033 West Van Buren Street, Chicago, Illinois

Sales and Service Offices in Principal Cities • In Canada: Canadian Telephones & Supplies, Limited, Toronto

★ MATCHLESS

NEW 1941 RITTENHOUSE CHIMES !

★ AMAZING

★ DIFFERENT FROM ANYTHING ON THE MARKET

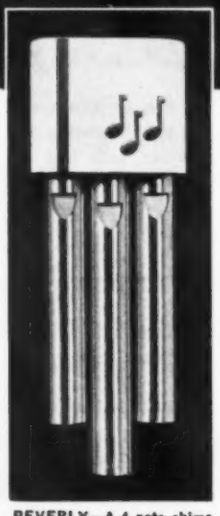
★ Strict Sales Policy Protects Your Interests

★ Styled with beauty to win your enthusiasm

★ Just crammed with "a lot of chime" for the money

★ Backed by complete national advertising and merchandising programs

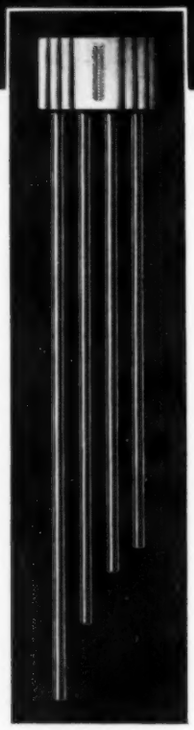
Rittenhouse Popularity
Will Build Big Fall and Christmas Volume!



BEVERLY—A 4-note chime at $9.95! A value never before offered for less than $20.00.

WINDSOR—2 notes front—1 note rear. Brushed brass resonator tubes with ivory plastic housing. A fast seller at $3.95.

AMBASSADOR—3 notes front door . . . 2 notes rear, plus single note maid's call. Rich plastic housing. Night light with cord pull switch. The finest in chimes at $29.50.



CAMBRIDGE—4 notes front door—1 note rear. Beautiful plastic housing brushed brass tubes. Exclusive Rittenhouse "Sealed Timer." Moderately priced at $19.95. 3-tube 3-note model $14.95.

Write for new catalog describing complete line priced from $1.00 to $50.00

THE A. E. RITTENHOUSE CO., INC.
Dept. 610, HONEOYE FALLS, N. Y.

RITTENHOUSE
ELECTRIC DOOR CHIMES

More Gossip

New Headquarters

The Scherer Electric Company, Inc., have moved into their new home at 936-946 South West Street, Indianapolis, where they are equipped to provide electric service to Indiana industries.

Fisher Now Manager

Robert E. Fisher, who for the past six years was an employee of the Allan-Westphal Company, an electrical firm of Janesville, Wis., has been named general manager of the Electrical Service Corp., at Green Bay, Wisconsin.

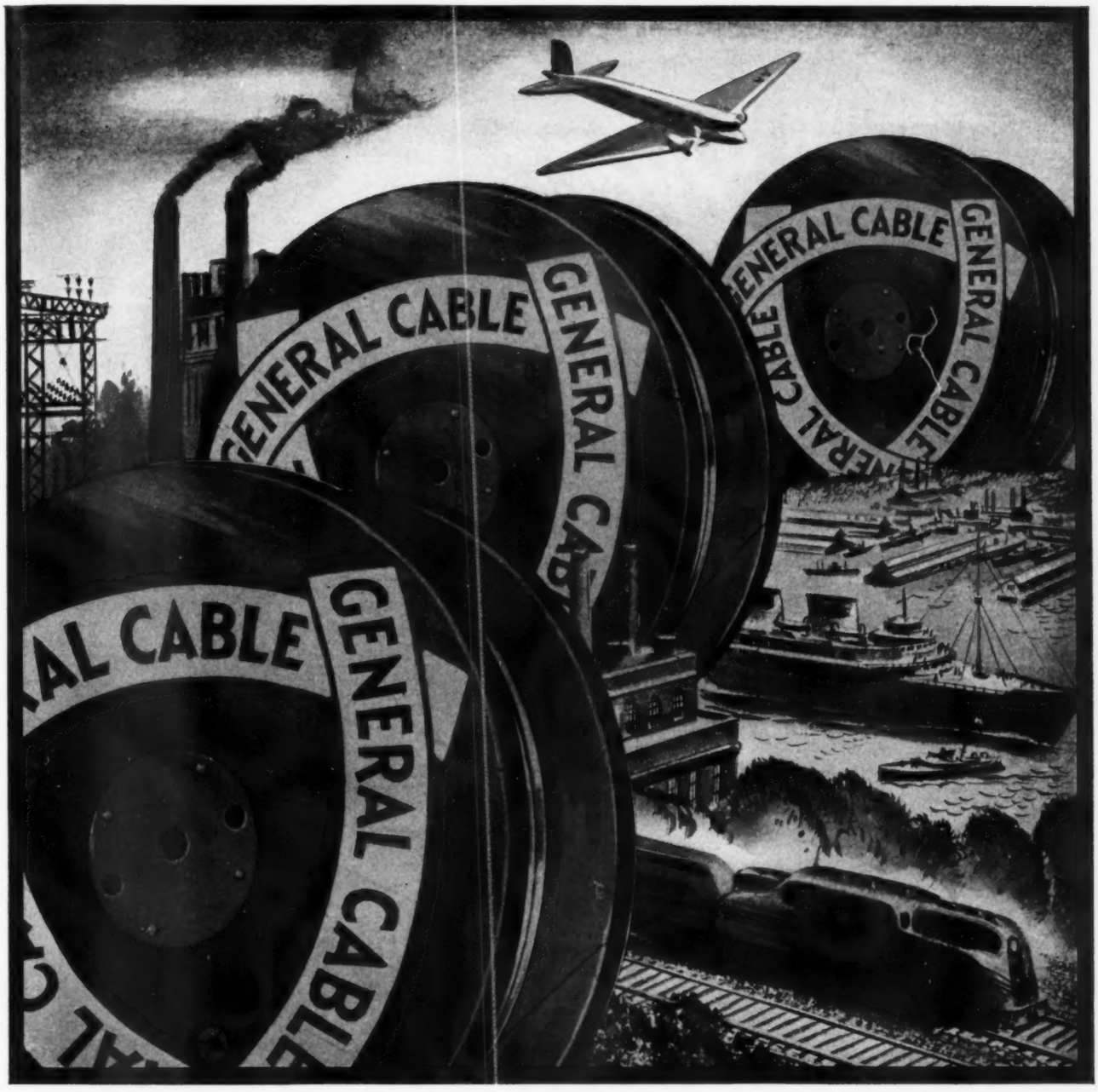
New Shop

The Cudahy Electrical Shop was recently opened by Samuel Migliaccio at 365 E. Holmes Ave., Cudahy, Wis. The firm will specialize in electric wiring installations.

TRANSFORMER REWINDING, *problem child of electric motor service shops was the center of much discussion at the recent N.I.S.A. convention in Detroit. Here Charles C. French consults an expert, Ellis Fagan of Little Rock, Ark. whose forthright discussion of the economics of transformer rewinding from his company's experience was one of the high spots of the meeting.*

Contractor Moves

L. H. Barrowclough has acquired larger quarters in the downtown business section of Lynn, Mass., where he will continue to operate exclusively in the electrical contracting business. He was for many years a contractor at Lynn and identified with the Mass. State Association of Master Electricians as state secretary.



Already Prepared

Anticipating the greater production that is sure to come with industrial preparedness, it is assuring to know that General Cable is already prepared to meet the increasing demand for quality wires and cables.

GENERAL CABLE

BARE and INSULATED WIRES and CABLES for EVERY ELECTRICAL PURPOSE

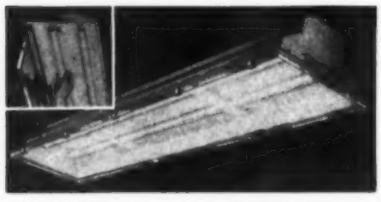
Stocked by Electrical Wholesalers Everywhere

General Cable Corporation Sales Offices: ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DETROIT
KANSAS CITY (MO.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROME (N.Y.) • ST. LOUIS • SAN FRANCISCO • SEATTLE • WASHINGTON (D.C.)

EQUIPMENT NEWS

Lighting Unit

The "Sealed-Flo" unit features a sealed cover construction which protects fluorescent lamps and reflecting surfaces from dust and dirt. It also extends use of fluorescent lighting to locations requiring vapor-proof and dust-tight fixtures, opal glass diffusing fixtures or "unbreakable" glass protection of lamps and reflecting surfaces. Cover is hinged to lamp housing and locked in place by means of hand operated cover clamps. When opened cover hangs straight down for easy servicing. Available in arrangements for either two or three 48-inch fluorescent lamps. Benjamin Electric Mfg. Co., Des Plaines, Ill.

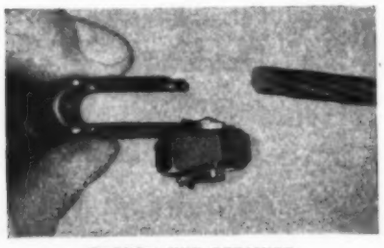


BENJAMIN LIGHTING UNIT

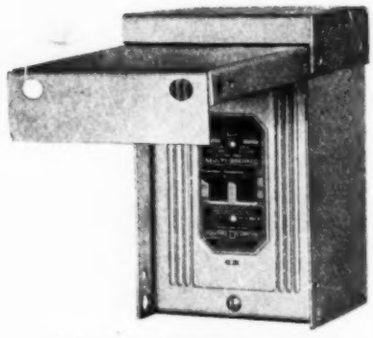
■

Nut Retainer

The new "Positive Position" nut retainer holds the nut-pressure bar assembly in any desired position in relation to U-bolt. Once the connector is on conductor, nut-pressure bar can be swung shut and thread pilot will guide nut on to U-bolt threads, eliminating cross threading and jamming. Frictional fit of nut retainer in U-bolt prevents any radio interference, which might result from loose, swaying parts. Available for all sizes of Burndy Servits from No. 6 solid to 4/0 stranded conductors. Burndy Engineering Co., Inc., 459 East 133d Street, New York, N. Y.



BURNDY NUT RETAINER



SQUARE D RAINTIGHT ENCLOSURE

Raintight Enclosure

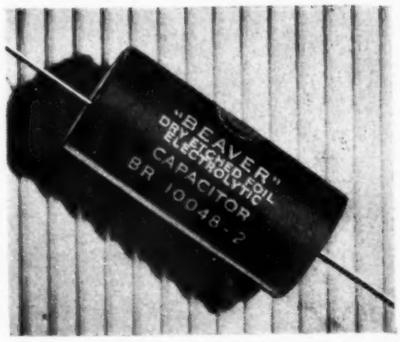
A raintight enclosure for 25-ampere frame type MO multi-breaker. Cover is removable for wiring. Outside dimensions are 7-in. high, 4½-in. wide and 3⅝-in. deep. Enclosure is a galvannealed steel hood which can be used to enclose any standard surface type MO multi-breaker. There is provision for padlocking the cover. Raintight hood and surface type MO multi-breaker are furnished as separate units. Square D Company, 6060 Rivard St., Detroit, Mich.

■

ILSCO LUGS AND CONNECTORS

Lugs and Connectors

New solderless lugs and solderless connectors have been developed. Bearing surface of tongues is arched, to fit curve of conductors held, so that maximum contact between tongue and conductor is assured and tongue pressure distributed over curve of wires held. Short, bar-like ridges or ribs project from inner, sloping walls of V-bottom collar to assist in gripping wires. Smaller sizes are equipped with fine-thread screws. Ilsco Copper Tube & Products, Inc., 5629 Madison Road, Cincinnati, Ohio.



CORNELL-DUBILIER CAPACITOR

Capacitors

A line of continuous duty a.c. electrolytic capacitors designed for starting service with low-voltage, "flea" power motors used in auxiliary control equipment of oil burners, air-conditioning equipment. They are of etched-foil, dry electrolytic type. Available in various capacities up to 50 mfd. and are all rated at 25-volts. Largest size is 1-in. by 2¼-in. Each unit is contained in hermetically sealed aluminum tube, which is jacketed in varnished cardboard tube for added protection and insulation. Can be supplied with mounting straps where desired and a choice of tinned wire leads or soldering-lug terminals is provided. Cornell-Dubilier Electric Corp., South Plainfield, N. J.

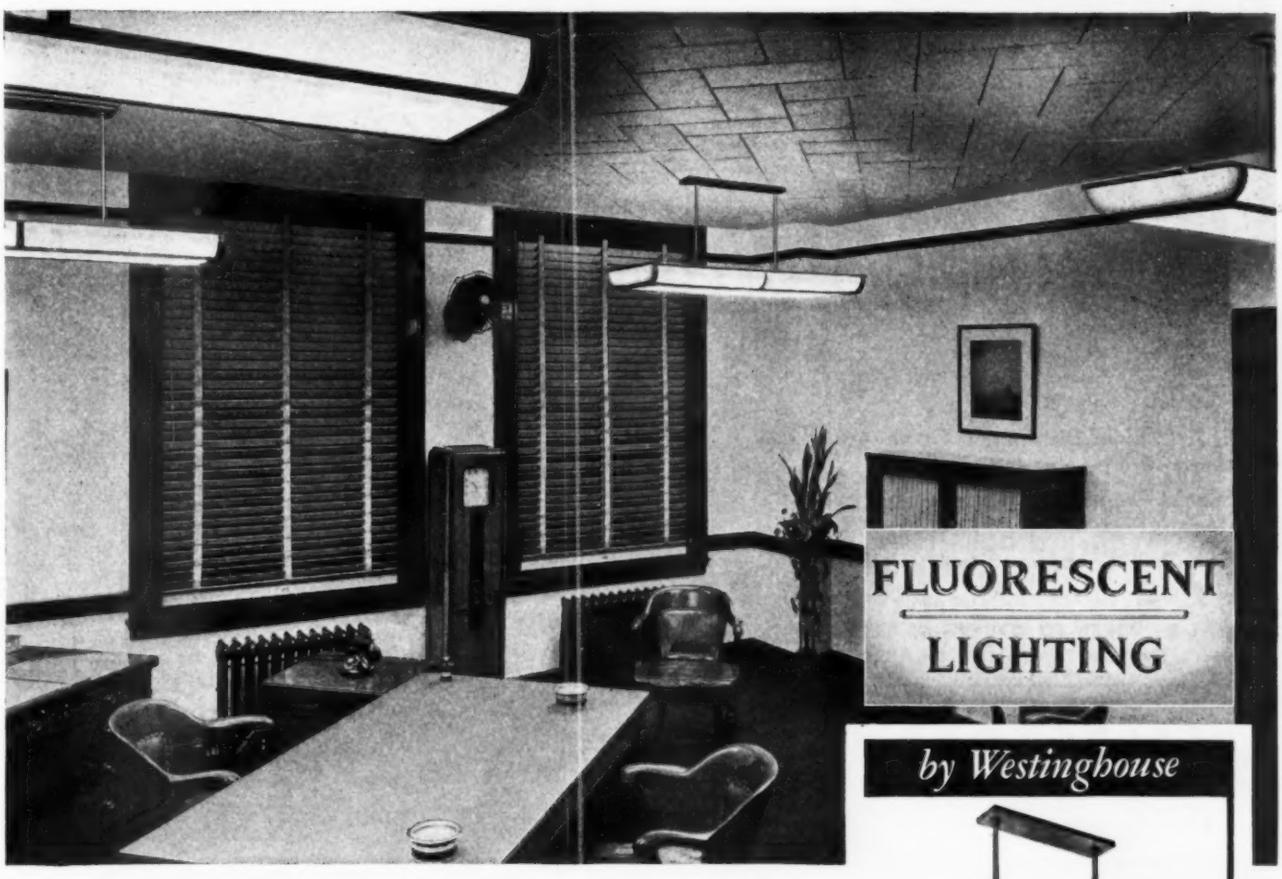
■

G-E MAGNETIC RELAY

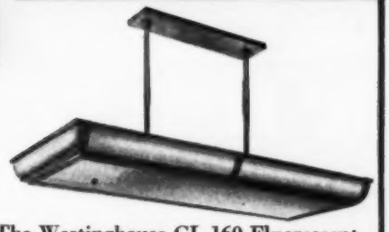
Magnetic Relay

A new magnetic relay with control transformer has been developed. Some of the uses are summer-winter control of heating boilers supplying domestic hot water; control of water circulator or blower on heating system in response to room thermostat; control of power apparatus on cooling systems in conjunction with room thermostat; operation of two oil burners from a single instrument application of power to unit heaters and unit coolers at direction of low-voltage thermostat. Controls consist of enclosed relay and low-voltage-transformer units. Relay is double-pole, double-throw. When used with 3-wire low-voltage devices, one pole is used as holding circuit. General Electric Company, Schenectady, N. Y.

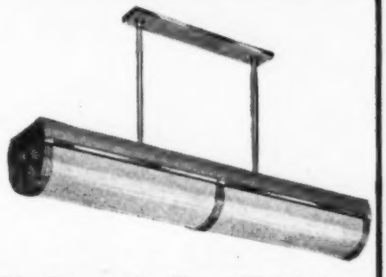
. . . TOMORROW'S ILLUMINATION TODAY !



by Westinghouse



The Westinghouse CL-160 Fluorescent Luminaire with ribbed or decorated glass bottom panel.



This fixture, the Type CL-110, has three lamps, is furnished with or without glass diffusing shield, and may be had for surface mounting.

MORE LIGHT, BETTER LIGHT...AND COOLER

To Building Management, Architects and Electrical Contractors Westinghouse Fluorescent Lighting offers a complete selection of fixtures for every commercial application. These specially designed Luminaires, entirely nominal in cost, give these highly desirable features:

High Illumination Values—at least twice the light, without glare or shadow;

50 Per Cent Cooler Light—permitting much closer placement of the fixture to the job; important in air conditioning.

The Type CL-160 Commercial Luminaire is available with either plain or decorated glass bottom, or with louver instead of glass. With louver, it provides more direct light, while the glass basins create semi-direct illumination.

Continuous Strip Lighting—for halls, general offices stenographic and drafting rooms—is available in the Type CL-40 fixture in one or two lamp lengths. By using extension sections, continuous runs may be easily installed. This Luminaire is available only for ceiling mounting.

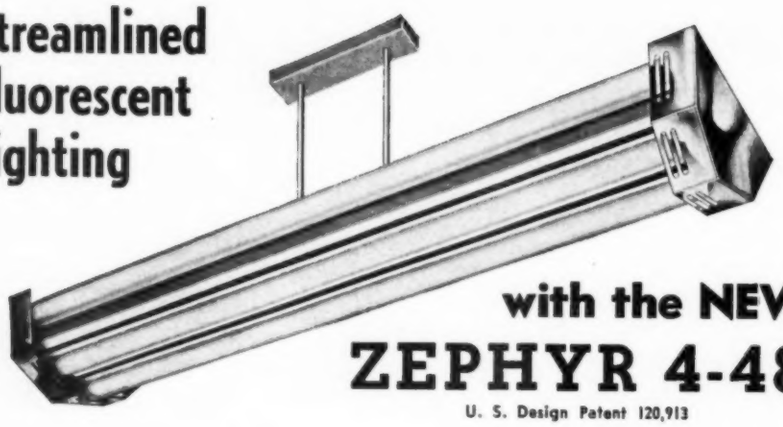
Another popular Westinghouse Fluorescent Luminaire is the three-lamp CL-110, which is furnished with or without glass diffusing shield as a combination indirect-direct unit or, without the top lamp, as a direct source of illumination. This fixture is also available for surface mounting.

117 Westinghouse Electric Supply Company offices or Independent Westinghouse Lighting Distributors are at your service locally with stocks and engineering services. Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland.

Tune in "Musical Americana," N. B. C. Network, Coast-to-Coast, every Tuesday evening.

Westinghouse
FLUORESCENT LIGHTING

Streamlined Fluorescent Lighting



with the NEW

ZEPHYR 4-48

U. S. Design Patent 120,913

- Consumes only 200 Watts

E. T. L. Light Distribution Curve Available Underwriters Labs. Inc., inspected

Special Finishes Available on caps, canopy & stems

Only E. T. L. approved ballasts sockets, etc., used.

MAY BE WIRED TO ORDER—AT EXTRA—WITH SWITCH TO LIGHT 2 OR 4 LAMPS

Check these features—

- Canopy & stems included stems 10-24 or 40"
- High Power Factor Tulamp Ballasts
- Starters insert in top without disturbing lamps
- High Bake enamel white reflecting box
- Durable aluminum finish on end caps stems & canopy
- All internal leads solder dipped
- You can easily punch canopy for switches or adapt it to wire raceway
- Strong Steel Design
- Ready to install—complete

REFLECTORS INC.

3225 FRANKFORD AVE., PHILADELPHIA, PA.

RHEOSTATS

THE WHOLE STORY IN A NUT SHELL

Ward Leonard Rheostats cover a range from the small types for fractional horsepower motors to the largest multiple units to control the heavy current requirements of rolling mills. The Bulletins covering the types, drives, mountings and accessories of the Ward Leonard Line is the whole story of Rheostats "complete in a nutshell".

Send for Rheostat data bulletins.

WARD LEONARD

ELECTRIC COMPANY

28 SOUTH STREET **MOUNT VERNON, N. Y.**

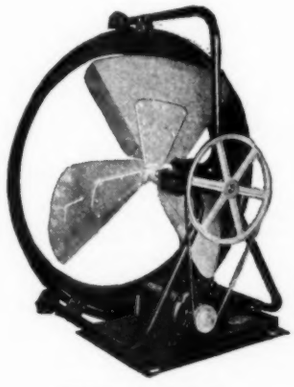
ELECTRIC CONTROL DEVICES SINCE 1892.

In the News

[FROM PAGE 86]

Fan

New cooler fan for complete home cooling, (attic installation) and for industrial and commercial use where it is desired to move a large volume of air. High-capacity, belted type available in three sizes—10,500 to 20,500 cfm. Quietness is obtained by use of wide, deep-pitch blades and relatively slow operating speed. Unit furnished with or without shroud ring. Equipped with repulsion-start-induction motor with V-belt drive. Wagner Electric Corp., 6413 Plymouth Ave., St. Louis, Mo.

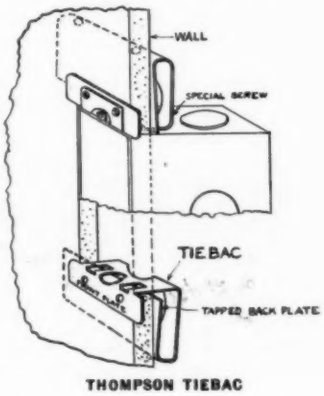


WAGNER COOLER FAN

■

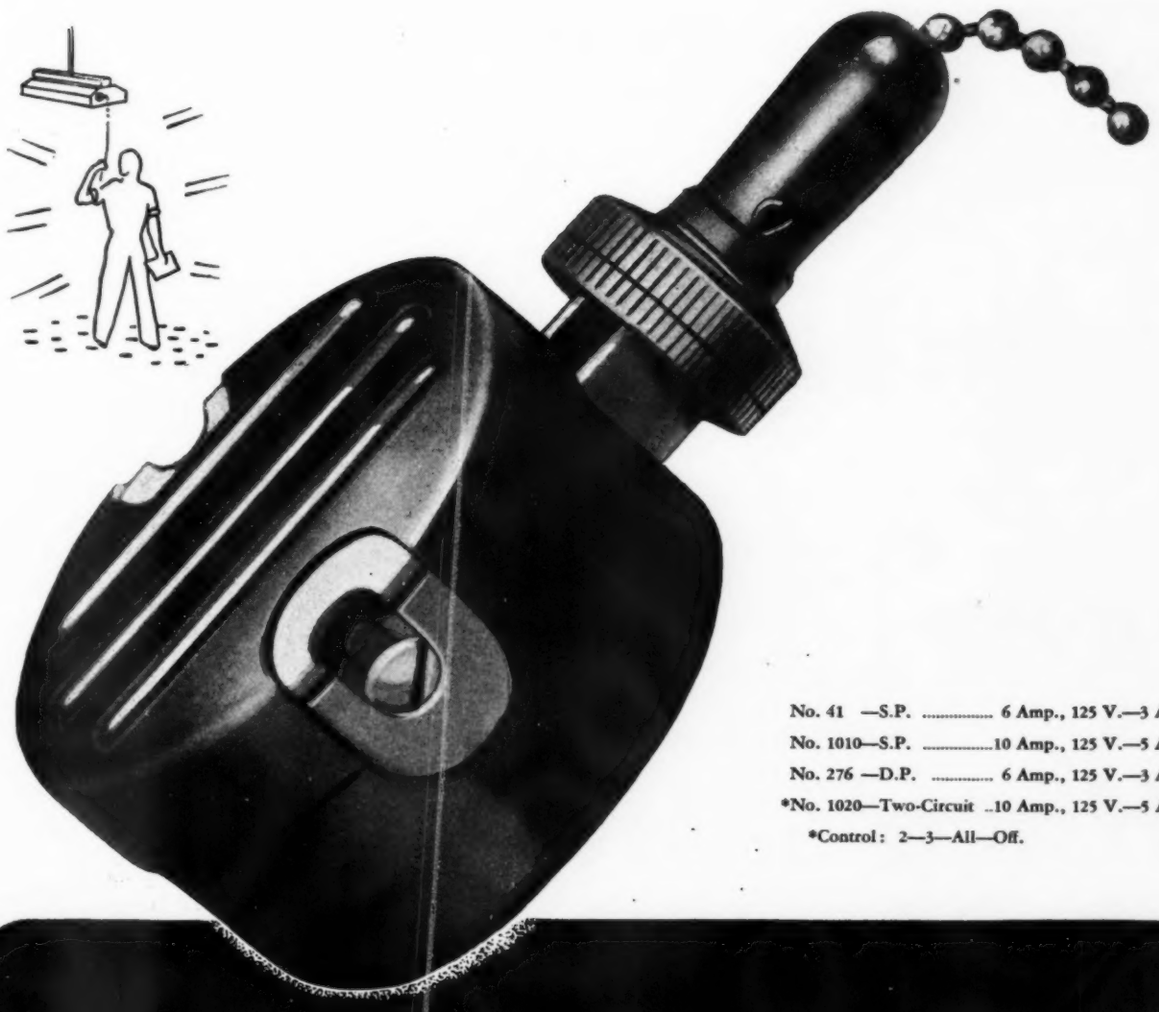
Clamps

Tiebac is a new method to install electrical outlet boxes. It is a set of clamps which slip into ends of hole cut to accommodate electrical outlet box. When box is in place and screw tightened, clamps grip wall and box is secure. Tiebac can be used in lath and plaster, wall board, plywood, metal lath and plaster or plaster board. Clamps leave all holes accessible for cables in both deep and shallow boxes. Thompson Manufacturing Co., 1211 Evarts Street, Northeast, Washington, D. C.



THOMPSON TIEBAC

THE DEPENDABLE SWITCH FOR FLUORESCENT UNITS



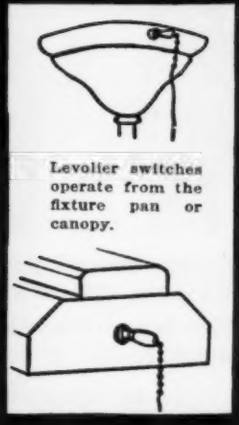
No. 41 —S.P. ..... 6 Amp., 125 V.—3 Amp., 250
No. 1010—S.P. ..... 10 Amp., 125 V.—5 Amp., 250
No. 276 —D.P. ..... 6 Amp., 125 V.—3 Amp., 250
*No. 1020—Two-Circuit .. 10 Amp., 125 V.—5 Amp., 250
*Control: 2—3—All—Off.

McGILL *Levolier*

REG. U.S. PAT. OFF.

Made to the rigid specifications of materials, workmanship, and engineering inherent in all McGILL products, Levolier switches offer an unparalleled record for dependable operation in thousands of installations. No extra wires are needed. Simply mount switch in the punched hole in Fluorescent fixture provided by the maker. You save considerable on labor and materials when fixtures are controlled with Levolier Switches. Designed to control 110-volt or 220-volt installations, they carry the load without pitting, arcing or heating.

Order from Your Wholesaler



Levolier switches operate from the fixture pan or canopy.

ELECTRICAL DIVISION

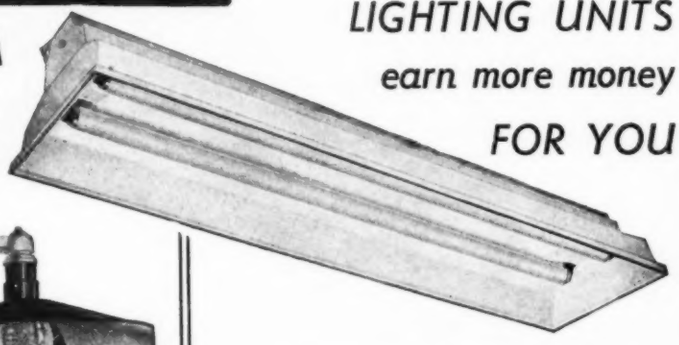
McGILL MANUFACTURING CO. - Box 670 - VALPARAISO. INDIANA

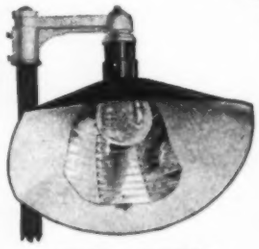
QUAD

Make those up-to-date jobs with QUAD LIGHTING UNITS earn more money FOR YOU

RLM

Fluorescent twin lamp porcelain enameled unit.





Long Beam Floodlights

RLM Standard Domes

★

★QUAD Lighting Unit installations go right to work for Contractors. Simplicity of installation and high lighting efficiency leave more time to take on more jobs—more jobs mean only one thing—more money! QUAD Units are modern—weatherproof and you can always find the right unit for any installation indoor or out. Good looking finished work—no after worries—that's what QUAD Lighting Units are noted for. See your Wholesaler or write us direct for more information.

QUADRANGLE MFG. CO.
32 S. PEORIA ST. CHICAGO, ILL.

Here's How

to install

Service Entrance Cable

Faster—More Economically

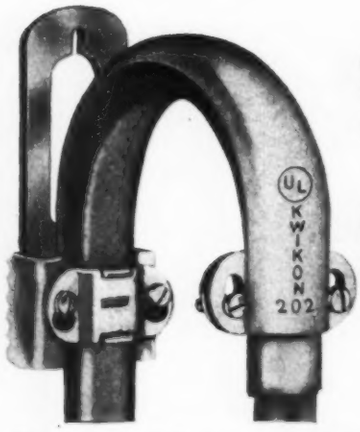
use

KWIKON No. 202

Service Cable Head

only 20c each

in lots of 50 or more



Economy and an easier and faster installation have made Kwikon No. 202 a national favorite. Improved by the new hanger type back, which makes the assembly and installation so much easier, it comes to you at no additional cost.

To be completely satisfied on your next Service Cable Head requirements, use Kwikon No. 202.

Approved by Underwriters' Laboratories, Inc.

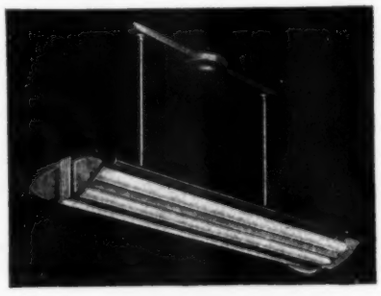
KWIKON CO. 626 W. JACKSON CHICAGO, ILLINOIS

EQUIPMENT News

[FROM PAGE 88]

Lighting Equipment

This new store and office luminaire, called Tru-Co-Lite, is for use with fluorescent lamps and provides direct-indirect lighting. Its reflectors deliver 85 per cent downlight with wide light distribution and 15 per cent uplight for ceiling illumination. It is available for 4—40-watt lamps or 4—20-watt lamps. Wired complete with 95–100 per cent power factor accessories and with separate starter switches. Edwin F. Guth Company, 2615 Washington Blvd., St. Louis, Mo.

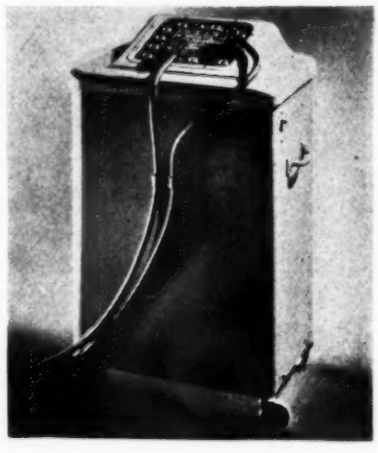


GUTH LUMINAIRE

■

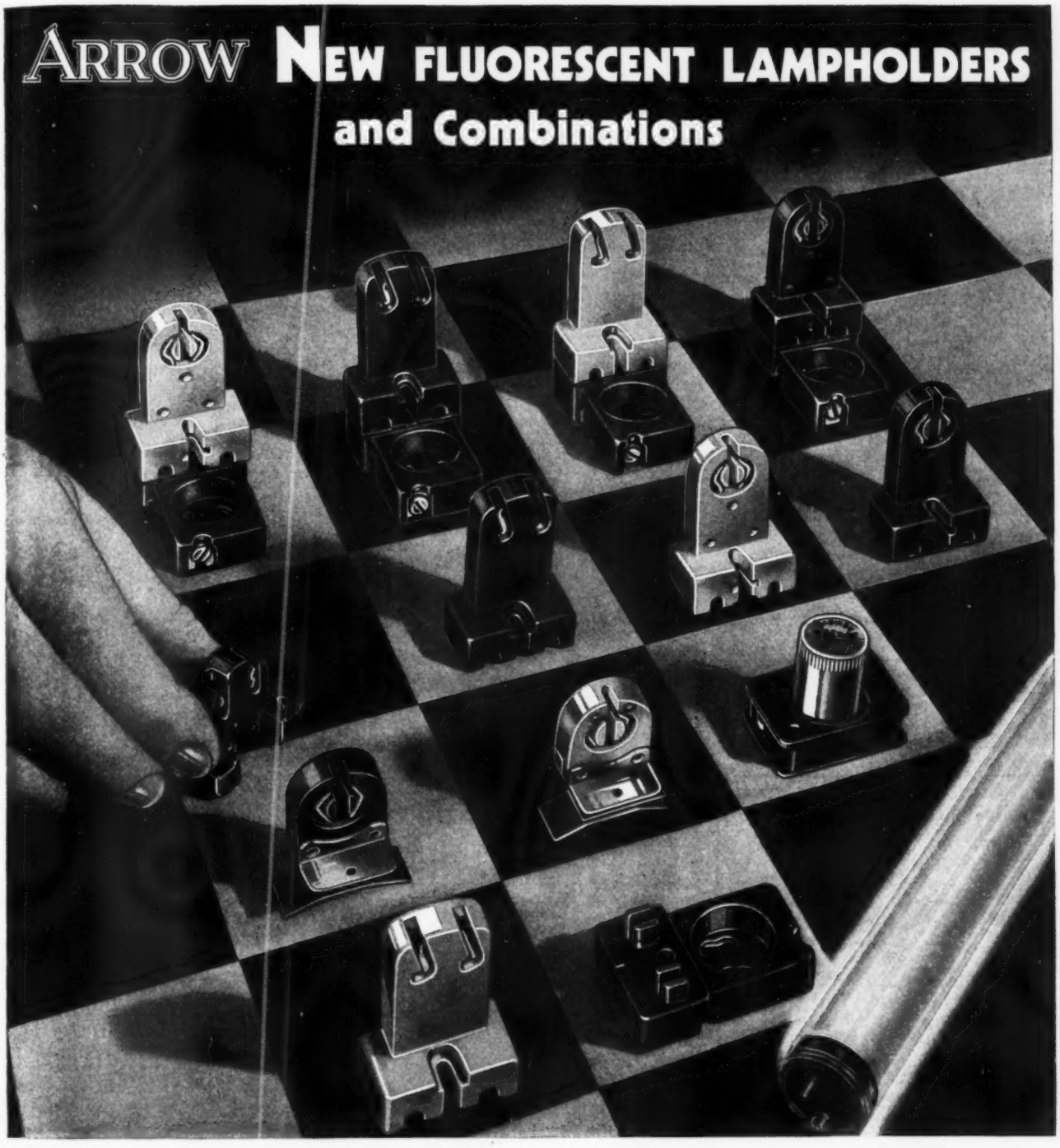
Welder

New continuous a.c. arc welders with controls and sockets in full view on sloped panel. Heats may be selected in gradual steps over wide range. Insulation is double spun glass. Current required at no load never exceeds 50 watts. Two models are available—No. 160 with current range of 15-160 amperes and No. 250 with 15-250 amperes. Operates on single phase or one phase of 2 or 3 phase current. Furnished complete with accessories—helmet, rubber-covered cable electrode holder and assorted sizes of electrodes. Ergolyte Manufacturing Co., 3644 Lawrence St., Philadelphia, Pa.



ERGOLYTE WELDER

ARROW NEW FLUORESCENT LAMPHOLDERS and Combinations



Your move now . . .

to stock this line in competitive play for the new market! Fluorescent lighting, in a single year, has jumped to the front as the commercial-industrial illuminating value of the age. In stores, offices, workrooms, factories, this cool light of almost daylight intensity has brought a system of illumination outmoding all others — and brings to you a mounting demand for its own special wiring devices.

The new *complete line* pictured above includes black and white Bakelite devices of the handiest types. Starter sockets and lampholders may be had as separate devices, or in *combination* Socket-and-Lampholder as illustrated. The starter unit, when mounted, projects through the reflector or channel-surface directly below the lamp . . . *YOUR MOVE NOW* — to be *adequately* stocked for the new installation-requirements in this field.

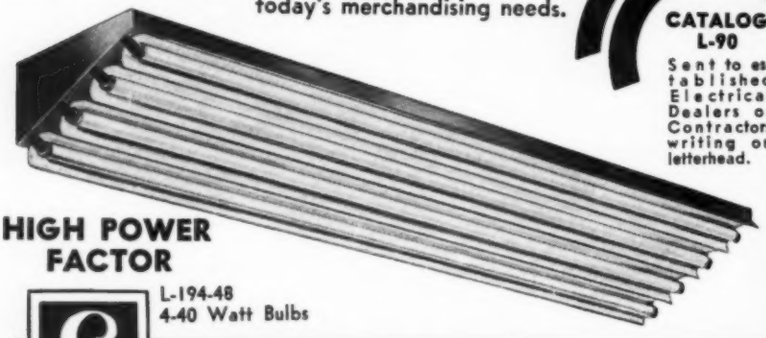
SOLD THROUGH YOUR **ARROW ELECTRIC DIVISION** ELECTRICAL WHOLESALER

THE ARROW-HART & HEGEMAN ELECTRIC CO. HARTFORD, CONN.

NEW EFCOLITE *Fluorescent* WINDOW UNIT

A NEW series of fluorescent window lighting fixtures designed to fill all requirements for correct store window lighting, with units to hold two, three, and four bulbs in 15, 20, 30 and 40 Watt sizes. Priced low to meet today's merchandising needs.

CATALOG L-90
Sent to established Electrical Dealers or Contractors writing on letterhead.



HIGH POWER FACTOR
L-194-48
4-40 Watt Bulbs

EFCOLITE CORPORATION TRENTON, N. J.

MINERALLAC HANGER

Conduit 3/8"—2 1/2"
Cable to 2 1/8" (with Bushings)

Cadmium and Everdur
MINERALLAC JIFFY CLIP

Sizes from .250" O.D. Tubing to 1 1/4" conduit.

See your Jobber

New York City Office
Theodore B. Dally
50 Church Street

MINERALLAC ELECTRIC CO.
25 N. Peoria St., CHICAGO

BIG BELLS for LITTLE PRICES

UNIVERSAL VIBRATING BELL

This non-adjustable, universal, vibrating type bell is of double coil construction. Recommended for such uses as burglar and fire alarms, call signals and elevators. Base and cover are drawn steel and gong is nickeled. Operates on either 1 1/2 to 3 volt battery or bell ringing transformer. Standard finish is black enamel. 5"—$1.60 list; 6"—$1.80 list; 8"—$2.80 list. See your jobber for your cost.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan
Offices in all principal cities

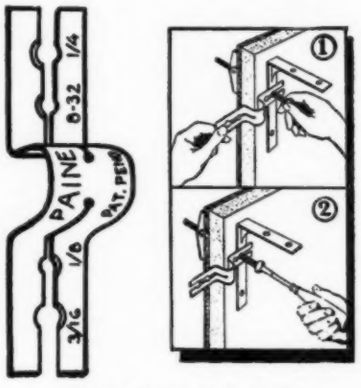
SIGNAL

EQUIPMENT NEWS

[FROM PAGE 90]

Toggle Bolt Clamp

A new clamp to use in the installation of all toggle bolts up to and including 1/4-in. diameter. It is made of spring steel, with die-sunk recesses on opposite sides of slots, providing a positive female threading action. When toggle bolt is ready to be tightened, pull it tight against inside of wall, floor or ceiling, slip clamp over bolt thread flush against bracket or fixture to be anchored and screw bolt tight with screw driver, then remove clamp and give bolt one more turn. It is small and can be carried in vest pocket. The Paine Company, 2961 Carroll Ave., Chicago, Ill.

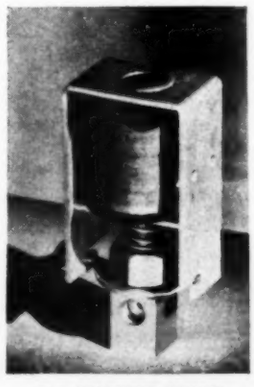


PAINE TOGGLE BOLT CLAMP

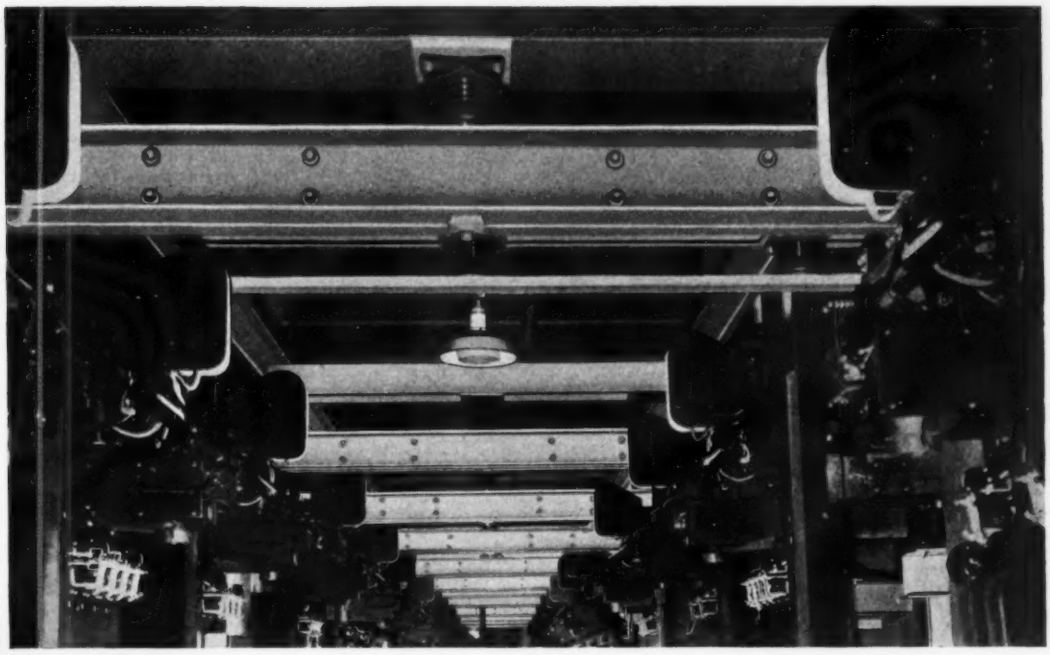
■

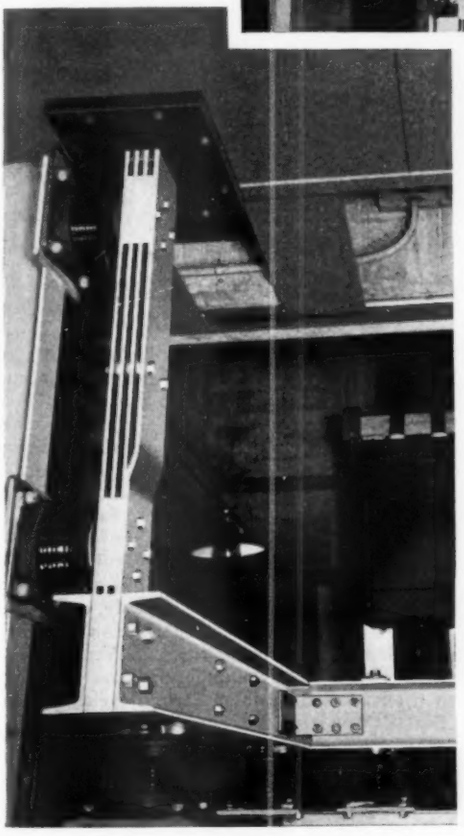
Solenoid Valve

A new solenoid valve adapted to requirements of heating and air conditioning industry has been developed. Also for general applications in control of air, oil, water and gas. It may be used as water control for humidifiers, water control for laundry and dishwasher equipment, oil shutoff for oil burner service, pilot-gas control for gas burners, air control for compressed-air devices. General Electric Co., Schenectady, N. Y.



G-E SOLENOID VALVE





Typical Aluminum bus installation at Irvin Works of Carnegie Illinois Steel Corporation.

Built to take the "jolt" of a 300,000-amp short circuit

Able to withstand a pull of 630 pounds per foot between positive and negative buses; equivalent to a 300,000-ampere short circuit. That's the high factor of safety for which the main power buses at Carnegie-Illinois' Irvin Works are designed.

Main buses are 10-inch Alcoa Aluminum channels, mounted eleven feet seven inches apart. Smaller Aluminum channels form the branch circuits.

Aluminum buses provide the high current-carrying capacity required for steel mill circuits. They are tailored to fit the exact requirement of each job. Their light weight facilitates fabrication and erection. Joints are made by bolting or welding. Simple, inexpensive fittings are available. ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh, Pennsylvania.

Show Window

FLUORESCENT LAMP FIXTURES

OAMCO Fluorescent Lamp Fixtures give efficient, uniform light for show windows. Complete reflecting surface is specular *Alzak. Fixture bodies are of steel with ½" knockouts in ends and top. Can be hung with chains or ½" conduit. Olive green outside. Reasonably priced and low in maintenance. Get our descriptive bulletin today.

*Registered Trade Mark Aluminum Co. of America

OVERBAGH & AYRES MFG. CO. 411 S. CLINTON ST. CHICAGO, ILLINOIS

Badger

Synchronous

ELECTRIC TIME SWITCHES

CONTRACTORS LIKE THEM BECAUSE:

they are dependable and easy to install

USERS LIKE THEM BECAUSE:

of economical operation and low cost

The Badger line of Time Switches is always in demand by Contractors who want dependability, accuracy, and the right type for a specific need. They know from experience that this is the line that gives them successful, profitable installations. They know when they install Badger Synchronous Electric Time Switches for their customers they are giving them complete satisfaction—accurate timing, economical operation, dependable service. You can't go wrong on Badger. Write for more particulars or see your Wholesaler.

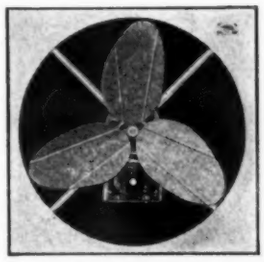
RELIANCE AUTOMATIC LIGHTING COMPANY
1937 MEAD STREET **RACINE, WISCONSIN**

EQUIPMENT News

[FROM PAGE 92]

Ventilating Fan

Allvent fans are for commercial, industrial and building applications. Features include "V" belt drive that makes possible slower, quieter operation and greater efficiency with 1750 r.p.m. stock motors; new design 3 blade fan wheel supplies or exhausts large volumns of air at low speeds; adjustable motor pedestals provides for proper belt tensions. Range from 1/6 to 1 hp. Can be installed for either horizontal or vertical operation. Autovent Fan & Blower Co., 1805 N. Kostner Ave., Chicago, Ill.



AUTOVENT ALLVENT FAN

■

Floodlight

Two new weatherproof floodlights for general use in business, industry, farm and home have been added to this line. Have one piece reflector with aluminum socket housing attached. Lens is held by metal retainer ring. Assembly is mounted on aluminum mounting bracket allowing horizontal adjustment. Either flat base or "ground spike base" may be had. A-8 fixture is 8-in. in diameter and uses 100-watt lamp; A-10 is 10-in. in diameter and uses 200-watt lamp. Available with plain or spread beam light distribution and with plain or colored lenses. Westinghouse Electric & Manufacturing Co., Lighting Division, Edgewater Park, Cleveland, Ohio.

WESTINGHOUSE FLOODLIGHT

❶ **First to be Wrapped and SEALED in Cellophane.**

❷ **Perfect Adhesiveness and Tensile Strength.**

❸ **Strong Distinctive Green Core.**

❹ **Colorful Attractive Boxes.**

❺ **A Company in the Insulation Business Since 1878.**

Sold Exclusively Through Distributing Jobbers

HAZARD INSULATED WIRE WORKS

DIVISION OF THE OKONITE CO.

WORKS: WILKES-BARRE, PENNSYLVANIA

New York Chicago Philadelphia Atlanta Dallas Washington Cleveland

Pittsburgh Buffalo Boston Detroit Seattle San Francisco St. Louis Los Angeles

STOP

NEEDLESS FUSE BLOWING

on washing machines, refrigerators, oil burners, and other electrical appliances

USE THERM-A-TRIPS

They protect motors against short circuits, excessive overloads, and small sustained overloads that might cause damage.

ASK FOR OUR BULLETIN 405

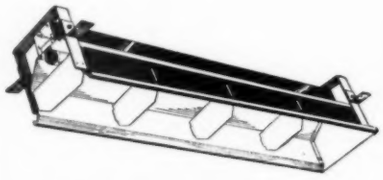
The
CHASE-SHAWMUT COMPANY
NEWBURYPORT, MASSACHUSETTS

EQUIPMENT NEWS

[FROM PAGE 94]

Lighting Unit

These fluorescent Troffers are used for continuous recessed lighting for general illumination of offices, factories, drafting rooms and similar locations. Reflectors attach to wireway channels by screws and cushioned washers after channels are installed in ceiling and all wiring completed. They are 12-inches wide outside and come in 2 foot lengths for 20 watt, and 4 foot lengths for 40-watt fluorescent lamps. Bolting to mounting support straps, channels form continuous rigid wireway in which all auxiliaries, sockets, starter switches, compensators and service wires are anchored, independent of reflectors. The Miller Co., Meriden, Conn.



MILLER FLUORESCENT TROFFER

■

Manual Motor Starters

A new line of across-the-line type manual motor starters designed for starting, stopping and overload protection of single phase and polyphase motors up to 7½ hp. Automatic relatching mechanism eliminates any resetting operation, as there is no intermediate or tripped position of starter handle. Operation is "handle free". Quick-break positive toggle mechanism is so designed that vibration or shock will not cause contacts to open. All metal parts are treated to prevent corrosion. Cover may be padlocked, leaving starter free to operate, or padlocked to lock it in "off" position and can serve as a disconnecting switch. Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn.

COLT'S STARTER

They're New!

NEW FEATURES . . .
NEW PRICES . . .
NEW MODELS . . .
and
NEW OPPORTUNITIES
for
Your Profit
with
A Complete New Line of
"AUTOMATIC" TIME SWITCHES

•

Write for Information

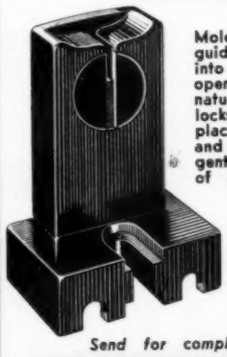
•

AUTOMATIC
Electric Manufacturing Co.
MANKATO, MINNESOTA

SAVE YOURSELF TROUBLE . . .

In replacing broken sockets in Fluorescent Fixtures use the ALDEN RoToLoK Socket. Users can't go wrong when using them. Impossible to get prongs behind contacts or set up wedging strains that generally break other makes of sockets.

When ordering new fixtures specify
ALDEN
RoToLoK
FLUORESCENT SOCKETS
Patents Pending



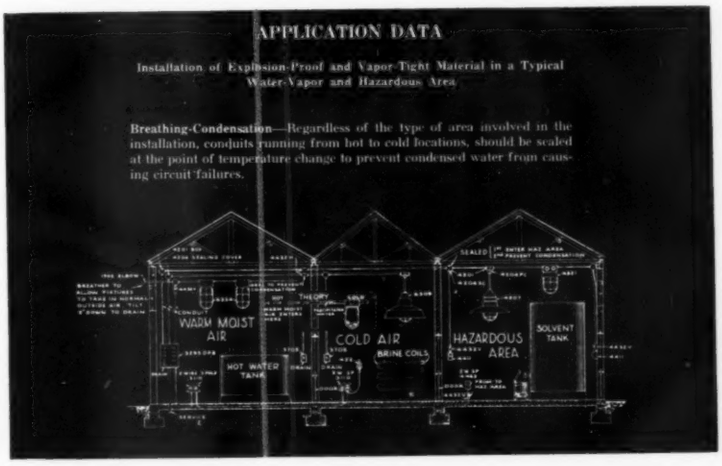
Molded end of socket guides lamp prongs into the one simple opening — then the natural obvious twist locks the lamp in place. A reverse twist and the ejector latch gently raises lamp out of socket and locks rotor ready for next insertion—a feature especially desirable in showcase and out-of-sight fixtures.

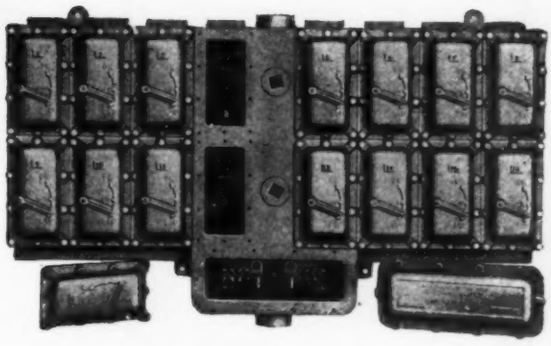
Send for complete story.

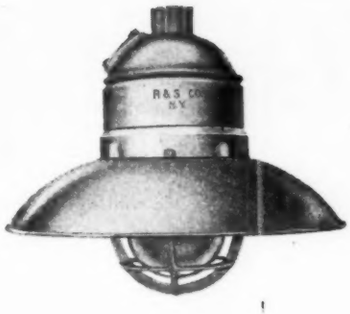
ALDEN PRODUCTS CO
718 CENTER STREET
BROCKTON, MASS.

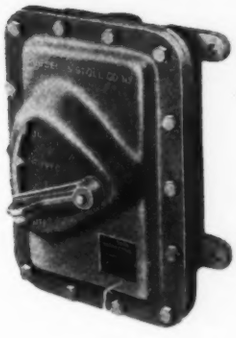
HAZARDOUS LOCATIONS

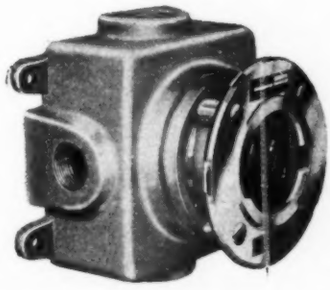
MORE than 40 pages of our No. 80 catalog are devoted to fixtures and fittings for hazardous locations. Considerable space has also been devoted to the new requirements of the 1940 Electrical Code, basic design and operating characteristics. The selection of proper apparatus for unusual requirements and examples of typical layouts as illustrated below:


APPLICATION DATA
Installation of Explosion-Proof and Vapor-Tight Material in a Typical Water-Vapor and Hazardous Area
Breathing-Condensation—Regardless of the type of area involved in the installation, conduits running from hot to cold locations, should be sealed at the point of temperature change to prevent condensed water from causing circuit failures.
WARM MOIST AIR
COLD AIR
BRINE COILS
HAZARDOUS AREA
SOLVENT TANK
HOT WATER TANK









With the speeding up of production in American plants on the defense program and the construction of new plants . . . the R & S specialties illustrated in the new 256-page catalog will help you answer many of the special installation problems you may be called upon to solve.

The coupon below is for your convenience —

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and subsidiary
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150 PARK PLACE NEW YORK, N. Y.

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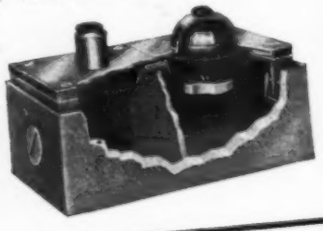
FLOOR BOXES *and* WIRING SPECIALTIES

No. 285 Double Duplex Receptacle Nozzle

The most attractive, compact, easy-to-install fitting on the market. Shown in the accompanying illustration with No. 200 Cover Plate.

No. 252-R Two Gang Box

Two gang adjustable floor box with No. 208 receptacle in one section. One cover plate with ½" flush brass plug and the other cover with 2" flush brass plug.



No. 110 "Latrobe" Watertight Box

Cut-away view showing how tapered unit receptacle fits tapered opening in top of box body. The latest in design, appearance, and simplicity of installation.

• The *Latrobe Line* is complete for all residential, commercial, and industrial requirements. In addition, the entire line is designed with the idea of reducing installation time . . . an important point to consider when selecting floor boxes and wiring specialties

Write for details TODAY!

FULLMAN MFG. CO.

LATROBE • PENNA.

EQUIPMENT *News*

[FROM PAGE 96]

Infra-Red Unit

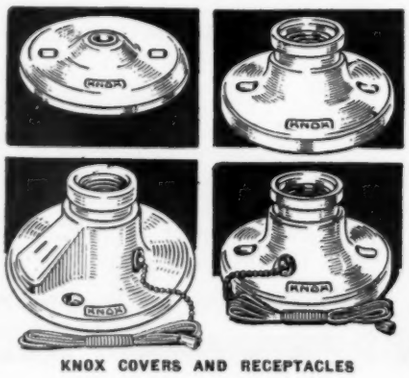
A portable flexible bank for infra-red baking and drying. Reflector bank extension is adjustable up and down or any position desired. Operates on yoke with ball and socket joints. Adjustable socket holder permits focusing of lamp to large or small spot. The bank of seven Para-Sphere reflectors will handle areas up to approximately 30-in. in diameter and to a height of from 18-in. to 6 ft. Available complete with reflectors and wiring but without lamps. Fostoria Pressed Steel Corp., Fostoria, Ohio.

FOSTORIA INFRA-RED UNIT

■

Covers and Receptacles

These porcelain covers and receptacles were designed to cover up plaster cracks, dirty spots and roughness around boxes. They are one-half inch larger in diameter than standard and fit any 3½-inch box. Design is modern and well proportioned. Knox Porcelain Corp., Knoxville, Tenn.



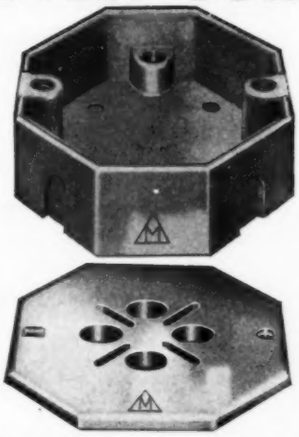
KNOX COVERS AND RECEPTACLES

Profit by USING

ILLINOIS

Dependable Porcelain

OUTLET BOXES



★ Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

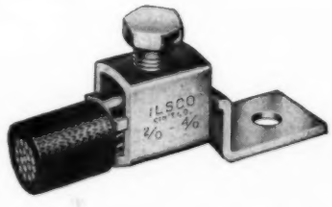
Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

ILSCO

SOLDERLESS CONNECTORS

. . . ARE APPROVED BY UNDERWRITERS' LABORATORIES



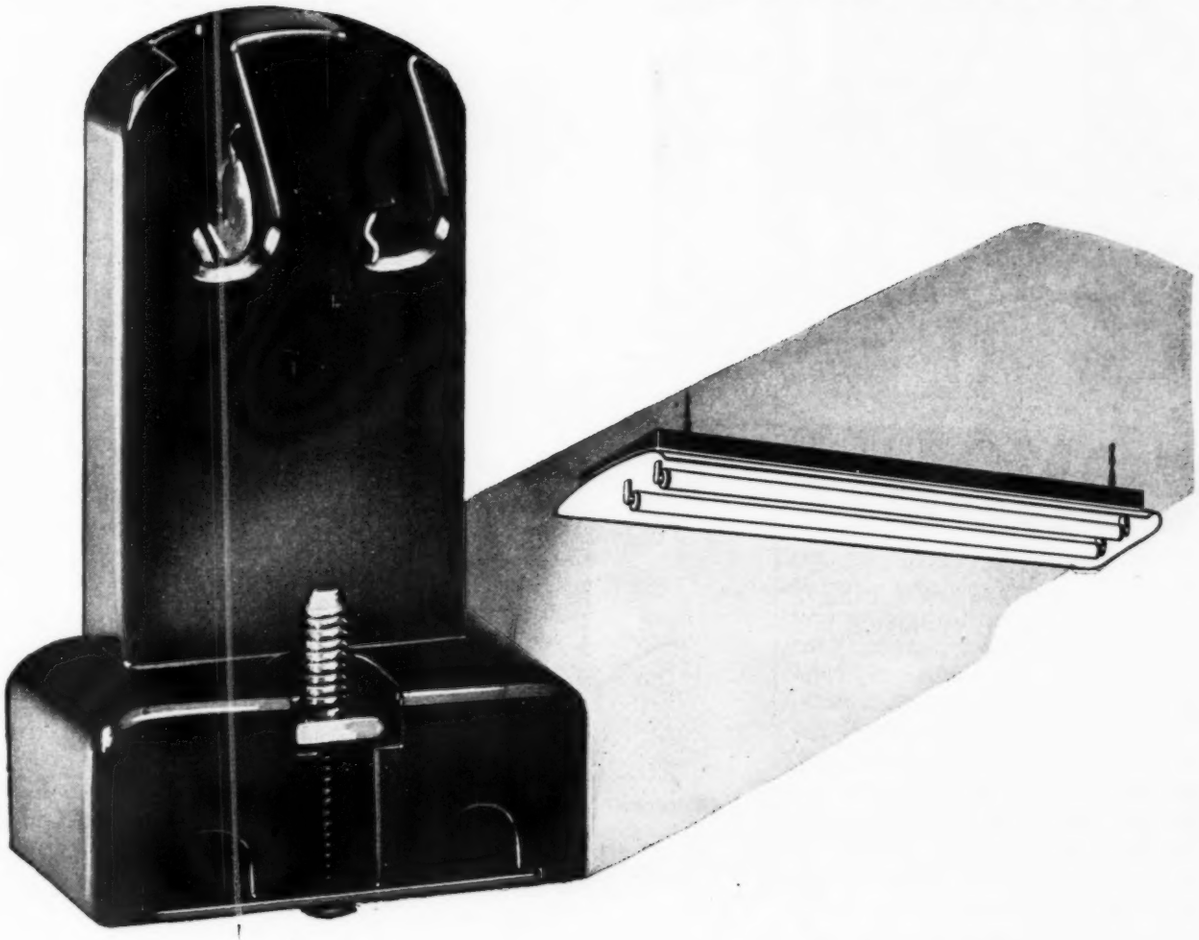
under new May 1, 1940, Standard for Pressure Wire Connectors.

Connect "FOR KEEPS" with ILSCO connectors. They're better than ever

Write today for samples.

ILSCO COPPER TUBE AND PRODUCTS, INC.
5629 MADISON ROAD — CIN., O.

EVERY OUTLET DESERVES A BRYANT DEVICE



Fluorescent LAMPHOLDERS

Up-to-the-minute design characterizes Bryant Fluorescent Lampholders. There are types for flush and surface mounting and for narrow channel mounting such as encountered in show cases. They are available in either black or white bakelite. Bryant starter sockets include a type for attaching to the lampholder and a type for separate mounting. Bryant easily replaceable starters round out this complete line of fluorescent devices. Be sure of value and performance by consulting the Bryant Catalog for every wiring device need.

BRYANT

SUPERIOR WIRING DEVICES

The Bryant Electric Company
Bridgeport, Connecticut

ADEQUATE WIRING SERVES AND SAVES

SOLD THROUGH ELECTRICAL WHOLESALERS NATIONALLY

Since 1901 *a subsidiary of* **WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY**

Ask this Man

ABOUT THE *NEW* "LINE-UP" ON

WIRE & CONDUIT

Wondering about the new types of small diameter building wire and how they fit into your picture? Your GRAYBAR Man knows the story complete. » » » Because GRAYBAR handles all types of standard and small diameter building wire: RHT, RPT, RU, SN . . . your GRAYBAR Man has no "axe to grind". He's ready with factual information on how to make the best use of each type under the new Code. What's more, GRAYBAR stocks are set to give you the wire you want *when you want it.* » » » For both rigid and flexible conduit, too, you'll find GRAYBAR a first-rate source of supply and an up-to-the-minute source of information on fields of service for every type and grade. If you're not yet acquainted with the new "Inch-Marked" Electrunite Steeltubes, for example, you'll want to check on this particularly. Call your local GRAYBAR office or write direct for information to Graybar Electric Company, Graybar Building, New York.

Are you taking advantage of GRAYBAR'S "one-call" supply service to save your buying time on any one of 60,000 electrical items?

ADEQUATE WIRING SERVES AND SAVES

GRAYBAR QUALITY SINCE 1869 — *Everything Electrical* — GRAYBAR ELECTRIC COMPANY

EQUIPMENT NEWS

[FROM PAGE 98]

Light Strip

A complete strip lighting system for 18-, 24-, 36- and 48-in. fluorescent lamps. Available for single and double row installations. It is used for illuminating coves, niches, luminous panels and decorative lighting of all kinds. Also for exposed mounting on ceilings for general illumination. Complete installation includes channel; snap-on channel covers; ballast clamps; service box or end caps; and coupling if installation is over 12-inches long. Asymmetric and symmetric reflectors in porcelain enamel or specular Alzak and cast aluminum. Day-Brite Lighting, Inc., 5401 Bulwer Ave., St. Louis, Mo.

DAY-BRITE LIGHT STRIP

■

Fuse Cutout

A new open fuse cutout has been designed for use on distribution circuits of 15,000 volts and below. Unit features totally enclosed contact construction for protection against snow and dirt, corrosion caused by weathering, and formation of ice on contacts. Toggle mechanism and lower contact are also enclosed. It also includes recoil-proof fuseholder, seamless fuse tube and interchangeable fuseholders. Contact is made by heavy spring contacts which press down against horizontal contact on fuseholder cap. When fuse link melts, contact is maintained for 10 to 15 cycles, after fuseholder has dropped, to provide time delay for clearing short-circuit current arc within tube. General Electric Co., Schenectady, N. Y.

G-E OPEN FUSE CUTOUTS

WIRING MADE EASIER, BETTER and SAFER

with IDEAL Wire Products

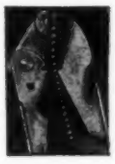
NEW — NOW only $1.50

No. 00 "Handy" FISH TAPE, REEL & PULLER

Gives you safe, sure grip while fishing—no costly tape breakage—no dangerous live wire contacts from loose tape. Only 7" diameter—easily fits in kit. Complete with 50 ft. of top quality ¾" x .045" tape. Ask about 7 other sizes of Reels to meet every requirement.

NEW — **BX ARMOR CUTTER**

Strips BX armor in one simple operation! No more nicked insulation—shorts—or wasted BX. Jaws take BX cable of any make, 2 or 3 wire, No. 12 or No. 14. Handy pocket size. Inexpensive.



"E-Z" WIRE STRIPPERS

Most complete line of wire strippers on the market, including handy pocket type shown, also bench, foot and power operated models. Strip solid or stranded wires and cables.

NEW — **JOIST BORING MACHINE**

Packaged Unit
Reduced Price
Ball Bearing Construction

Everything but the pipe—chain, fittings and bit—complete in handy package. Easily assembled. Bores at any angle through rafters, joists and studdings, above or below floor level. *No climb—no stoop—no strain!*

Wire Nuts

Solderless, Tapeless Wire Connectors

Strip wires, screw on, that's all! Just the thing for fluorescent lighting installations and a hundred-and-one other wiring jobs. Better electrically, stronger mechanically than the best soldered joint. Sizes for any common wiring joint from 2 No. 20 to 3 No. 10.

Fully Approved: Listed by Underwriters' Laboratories, Inc.

NEW "Snap-Tite" SWITCHBOX SUPPORTS

Securely hold any standard switchbox in composition walls. No screws or special tools required. All fastenings outside box. Easy to install, inexpensive!

Ask About IDEAL Fuse Items

IDEAL SOLD THROUGH JOBBERS

Electrical Products Division

Ideal Commutator Dresser Company

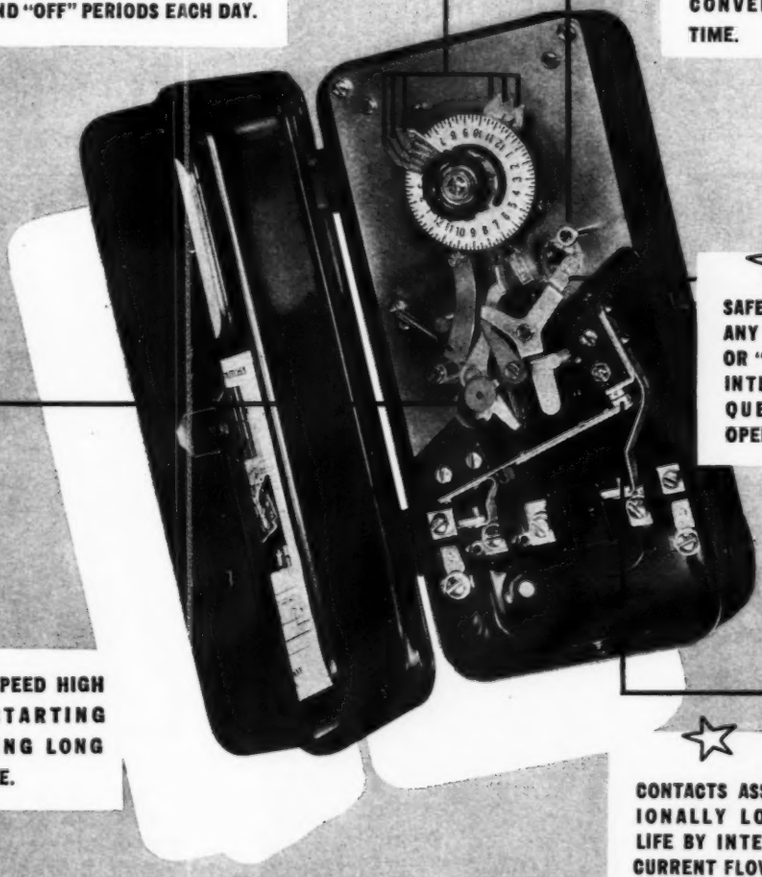
1041 Park Avenue — Sycamore, Illinois

IS THIS FEATURE

ON THE TIME-SWITCH YOU NOW BUY?

SIX LEVERS PROVIDING FOR EITHER ONE, TWO OR THREE COMPLETE "ON" AND "OFF" PERIODS EACH DAY.

MANUAL RESET STAFF ENABLING ACCURATE AND CONVENIENT SETTING OF TIME.



CONVENIENT AND SAFE TRIPPING BY HAND AT ANY TIME, TO EITHER "ON" OR "OFF" POSITION, WITHOUT INTERFERRING WITH SUBSEQUENT AUTOMATICALLY OPERATED TRIPPINGS.

A LOW SPEED HIGH TORQUE SELF-STARTING MOTOR ASSURING LONG TROUBLE-FREE LIFE.

STURDY SILVER CONTACTS ASSURING EXCEPTIONALLY LONG CONTACT LIFE BY INTERRUPTING THE CURRENT FLOW IN LESS THAN HALF A CYCLE.

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS

McGILL

LAMP CHANGER

Eliminate the hazards of falling off step-ladders, chairs or boxes while removing or inserting lamp-bulbs.

Popular for years with firms interested in cutting down industrial accident losses, the NEW model McGill Lamp-Changer has even further safe-guards embodied in its construction. Now, rubber-covered fingers with a coil spring around the tips, make for much quicker and easier removal or insertion of the bulb. The automatic locking device, between each pole-section, assures rigidity in every length of pole, up to the 30-foot maximum. The flexible joint, with cord attached, provides for easy operation at any angle.

Insulated for Safety

The McGILL Improved Lamp-Changer is insulated for safety. One section, including a 1¾-inch insert of insulating material prevents any shock or injury to the user, should the Lamp-Changer come in contact with exposed live wires. Regardless of the length pole you order for your Lamp-Changer, the insulated section is included.

Why run risks any longer in your plant? Send now for a McGILL Lamp-Changer to protect life and save costly accidents in your organization.

(Listed by Underwriters' Laboratories)

McGILL Products Can Be Secured from Your Electrical Wholesaler

McGILL MANUFACTURING CO.
Box No. 670 VALPARAISO, IND.

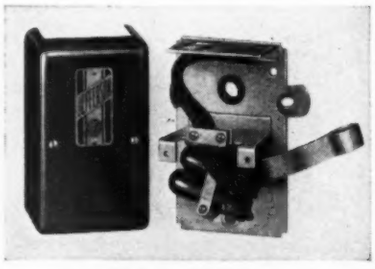
McGILL

EQUIPMENT NEWS

[FROM PAGE 100]

Control Switch

A control switch in which circuit is made and broken inside ferro-tube mercury contacts has been added to this line of switches. Can be operated by hand, foot treadle, float or pressure in connection with signals, relays. It can be furnished with one mercury contact for single pole or pair of contacts may be used for double pole make and break, or for controlling two separate circuits. Capacity up to 1875 watts per mercury contact (resistance load) on circuits up to 440-volts a.c. and 250-volts d.c., for ¼ hp. a.c. split-phase motors, ½ hp. a.c. capacitor motors and ¾ hp. a.c. repulsion motors. Jefferson Electric Co., Bellwood, Ill.



JEFFERSON CONTROL SWITCH

Lighting Fixture

This new indirect luminaire has shallow appearance, with reflection and distribution of light by a silvered glass reflector. It is the luminous bowl type and made of spun aluminum. Skirt may be attached to bottom of husk to cover exposed portion of lamp neck. It uses 300-500 watt lamp. The upper bowl is designed and mounted to trap a subordinate spill of light, creating a translucent effect which resembles illuminated glass. Pittsburgh Reflector Co., 403 Oliver Bldg., Pittsburgh, Pa.

PITTSBURGH PERMAFLECTOR

WOLVERINE SOLDERING LUGS

- *High-Conductivity*
- *Square-End*
- *Uniform Dimensions*

BUY FROM YOUR JOBBER

WOLVERINE TUBE CO.
DETROIT, MICHIGAN

SIRENS

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FOR
- Fire Alarm
- Start and dismissal
- Low water alarm
- Breakdown signal
- Call System
- Cranes and conveyors
- Shop and warehouse trucks

Ask for Industrial Literature

Federal Electric Co., Inc.
8726 S. State St. Chicago, Ill.

"I SELL 2 OUT OF 3 WHEN I SEE 'EM AT HOME!"

Above—rear view of "Built-In" Fan Demonstrator

"BUILT-IN" MODEL (front view) —for permanent installation in walls of new or modernized kitchens. Demonstrator plugs-in—weather-tight door opens and closes, fan starts and stops. Prospects *see* the fan in operation as it will actually appear after installation . . . *hear* the results of ILG's smooth, effortless, supremely quiet operation.

"PORTABLE" MODEL (front view)—with adjustable panel . . . installs with eight screws in any kitchen window frame. Ideal for tenants of rented homes or apartments. Demonstrator plugs-in . . . fan operates . . . your customers can *feel* the quality of ILG's "lifetime" construction . . . are *convinced* by the fascinating "match test" (proof right before their eyes of ILG's exclusive self-cooled miracle motor that "breathes"—never "gums-up" to interrupt service, shorten life!)

FREE KITCHEN FAN DEMONSTRATORS

ILG "SCOOPS" THE INDUSTRY! Two new multi-purpose demonstrators help salesmen *close* sales of kitchen ventilating fans in new and old homes or apartments—to home-owners, landlords and tenants! Brilliant orange and green colors arrest the eye in window or counter displays. Short, terse copy phrases tell the story to "lookers", *invite* a request for demonstration, help salesmen *remember* all sales-making features. *Easily carried* and used by house-to-house canvassers, or on appointment in the home *where sales are made.*

ILG's "built-in" or "portable" model Kitchen Ventilating Fans have always sold fast WITH *full profit margins,* WITHOUT *money-wasting trade-ins.* Now with sales-tested demonstrators, they offer a profit-making opportunity you *cannot afford to miss.* Write, wire or phone your ILG distributor or nearest ILG office today. Act now—get the jump on competition!

Nationally Advertised

In House Beautiful and House and Garden

Millions of home-lovers, right in the midst of holiday cookery, will learn how ILG "K.O.'s" Kitchen Odors, cooking heat, smoke and fumes. Cash-in on this hard-hitting campaign—get samples of free dealer helps now.

ILG

Vitalized VENTILATION

AND AIR CONDITIONING

★AIR CHANGE...NOT JUST AIR MOVEMENT!

ILG ELECTRIC VENTILATING CO., 2879 N. CRAWFORD AVE., CHICAGO, ILL. OFFICES IN 43 PRINCIPAL CITIES

The easiest way to get ahead in electricity—

through the other man's experience as found in books

Whatever "getting ahead" means to you as an individual, there is no principle so important as backing up your brain with the other man's experience. Why spend time and effort to find out what has already been learned and put down for all to see in books? Here, for instance, are all the results of a rich experience in every stage of wiring, installation and contracting work gathered and set down for you in

Terrell Croft's

AMERICAN ELECTRICIANS' LIBRARY

(6 volumes — over 3,000 pages — fully illustrated)

In six really magnificent volumes this library gives one of the most thorough, complete and easy-to-understand treatments of the more specialized phases of electrical practice in print today.

"How" and "why" for Maintenance Men

The books show the best ways to make installations for every type of conduit wiring job—they tell how to handle every kind of lighting and switch problem—they give tips on short-cuts for saving time on routine jobs—they show the quickest and surest methods of locating and remedying circuit troubles. Alternating current armature winding, electrical machinery control diagrams and machinery erection are some of the things covered in detail.

Diagrams

In all, these books contain more than 1,000 clear, easy to follow diagrams, with wiring instructions written in simple language. It is unnecessary to tell you how valuable is this one feature alone.

Small monthly payments

You may examine these books for 10 days by sending the coupon below, filled out. In addition, if you decide to keep the books you have the privilege of paying for them in easy monthly installments while you use the books. Make sure you are not passing up your best bet for getting ahead. Mail the coupon today.

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(Books sent on approval in U. S. and Canada only.)

EQUIPMENT News

[FROM PAGE 102]

Connector

Electrical connector, known as Versitap, type QPX, may be used as a parallel tap, a T-connector, a cross connector or end-to-end connector. Will clamp large range and combination of cable sizes in either main or branch connection grooves. Each clamp accommodates range of sizes and overall dimensions on line decrease when supplied for smaller diameter conductors. Recommended for use in industrial and building wiring. Burndy Engineering Co., Inc., 459 East 133d St., New York, N. Y.

BURNDY CONNECTOR

Floodlight

An "Alzo-Lite" medium-spread floodlight with water-proof hinged glass cover for use in outdoor sports lighting, as well as industrial yards, service stations, parking lots, etc. Cover gives protection to lamp and reflecting surfaces against rain, moisture, dust, dirt, fumes or smoke. Other features are stream-line hood and vertical stop in cross arm mounting bracket by which floodlight may be tilted back over top of cross arm for servicing. Benjamin Electric Mfg. Co., Des Plaines, Ill.

BENJAMIN FLOODLIGHT

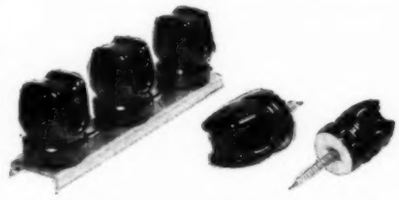
Sherman solderless Connectors are strong, well made, easy to use — and they'll carry BIG LOADS. Made in a wide range of types and sizes, for virtually all requirements. Write for Bulletin 22.

Wedge-Grip Connectors —Pure copper, with non-removable screw. Designed to provide extra wedging and snubbing action.

Split Bolt Connectors — Highest grade special alloy bronze, with strong, clean, machine cut threads. Solid spacer, full hex head. With or without nut retainer.

H. B. Sherman Mfg. Co.

BATTLE CREEK, MICH.



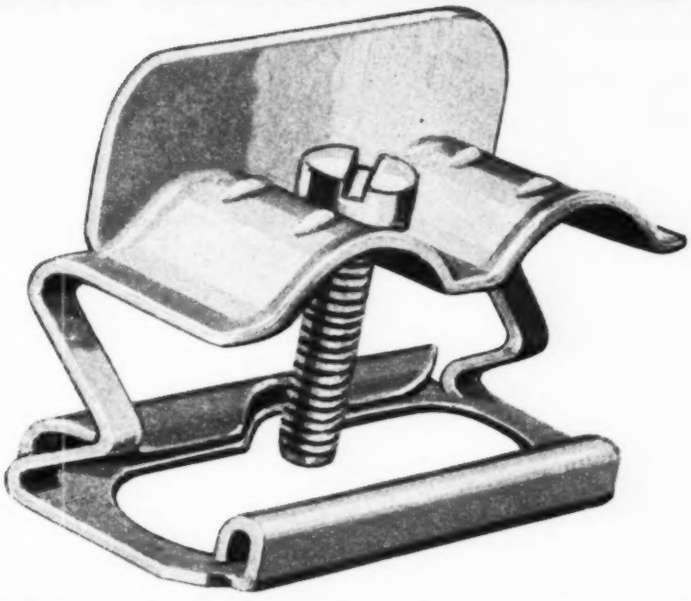
A Combination That's HARD to BEAT

For service entrance work that calls for minimum maintenance and maximum economy, plus durability backed by good design, you can't beat Porcelain Products' line of quality Service Knobs and House Brackets. Large well rounded wireways, generous thicknesses of porcelain where it is needed most, great strength and smooth heavy galvanizing on all exposed metal are features of all House Brackets and Service Knobs made by Porcelain Products, Inc. Insist on receiving these on the next order you place with your jobber. Complete information gladly supplied on request.

PORCELAIN PRODUCTS, INC.

FINDLAY, OHIO

WIRING MARCHES ON!



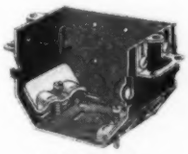
"NM" CLAMP

RACO·ALL-STEEL KEEPS IN STEP BY DEVELOPING CLAMPS FOR EACH WIRING REQUIREMENT

MCL Switch Box with LX Clamp

Wiring has made rapid strides in the past decade. A wide-awake attitude has been necessary to keep Switch Boxes, Outlet Boxes, and Conduit Fittings ahead of the trends. During this period Raco • All-Steel has kept pace and offers an outstanding line, tailored to fit the 1940 trends. Their pioneering in the refinements of clamping devices and boxes is typical.

The MCL, a conventional square-cornered box (pictured) equipped with type LX clamps, has been a standby for years. It is designed for use with Non-Metallic Cable or flexible Non-Metallic Tubing.



BLN Box with BN Clamp

To the left is shown the BLN box, a recent refinement of the old familiar beveled corner box for Flexible Metallic Tubing (Loom). Raco • All-Steel's development of the type BN clamp, together with a well-rounded embossed "seat" provided in the bottom of the old "Loom" box, assures an ideal installation for Non-Metallic Cable. There is no chance of injury to the cable braid.

The DO-10 box, a ceiling pan, ¾" deep—equipped with type UN clamps. This job was not adequately performed by the ordinary clamp. Raco • All-Steel supplied the answer. The UN clamp assures full protection to even the smallest diameter Non-Metallic Cables.

DO-10 Box with UN Clamp

DO-21N-3 Box with new NM Clamp

At the left, is a 3½" octagon, 1½" deep, cable box, equipped with the latest Non-Metallic Cable clamp—the NM clamp. Its outstanding features bid well to make it the most popular of Non-Metallic clamps. Cables may enter the box from the side or the bottom of the box or from side and bottom simultaneously. *And you don't have to change position of the clamp.* You cannot injure the cable braid—no matter what position it is in.

Why not be sure you're in step with the latest wiring trends? You'll know you are—if you standardize on Raco • All-Steel products. They provide many advantages for rural and urban modernization work, as well as on new jobs. A copy of the Raco • All-Steel products catalog is yours without any obligation. Write us today.

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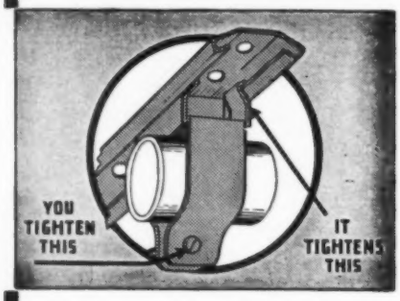
THE CLEVELAND CONDUIT HANGER



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Please Rush FREE Catalog.
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Underground Wiring Methods

[FROM PAGE 11]

To prevent any displacement of the duct structure and to guard against voids—a steel deflecting trough is used to pour a comparatively wet or sloppy mix of concrete along the sides of the trench and up through the duct structure. A long flat slicing tool should be worked up and down between the ducts to assure even distribution of the concrete around the ducts.

The "tier-by-tier" method starts with a concrete foundation in the bottom of the trench. The proper thickness, is determined by grade stakes, and is tamped evenly. The first tier of ducts is laid on this base.

The horizontal spacing and alignment of the ducts is maintained by the use of a wooden comb—which any contractor can make from scraps of wood. The width of the comb teeth is the same as the distance between ducts, usually one inch. The distance between the teeth depends on the size of the duct. The thickness of the back of the comb is usually three inches to gage the amount of concrete above the ducts. The combs are removed and used to guide the next tier.

Thus the duct bank is built up tier-by-tier. A comparatively dry mix of concrete is used to give a firm base for the ducts and succeeding layers of concrete.

Wherever such a concrete encased duct bank crosses under a roadway that is subject to heavy truck traffic, it is good practice to build a frame of steel reinforcing rods around the duct to strengthen the conduit envelop.

The ducts should be tied down, especially in the "built-up" method, to prevent them from "floating" and becoming misaligned, while pouring.

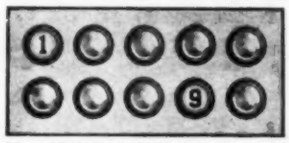
A water proof compound should be used at the couplings. This is usually applied to the tapered ends of the duct so it will work outward away from the coupling center when the duct is driven home. This will prevent the compound entering the conduit, hardening and forming an obstruction.

2. *Trench Burial of Ducts*—Asbestos-cement and fibre conduit for installation directly in the ground without a concrete envelop has much thicker walls than that used with concrete. This duct is installed by the "tier-by-tier" method using dirt backfill.

Smooth dirt or sand, free of stones, should be used in the trench as a bed

[Continued on page 110]

HOW TO BUILD LAMP ANNUNCIATORS



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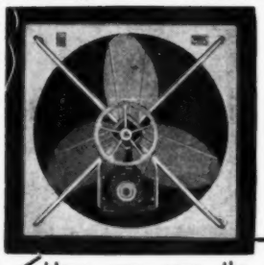

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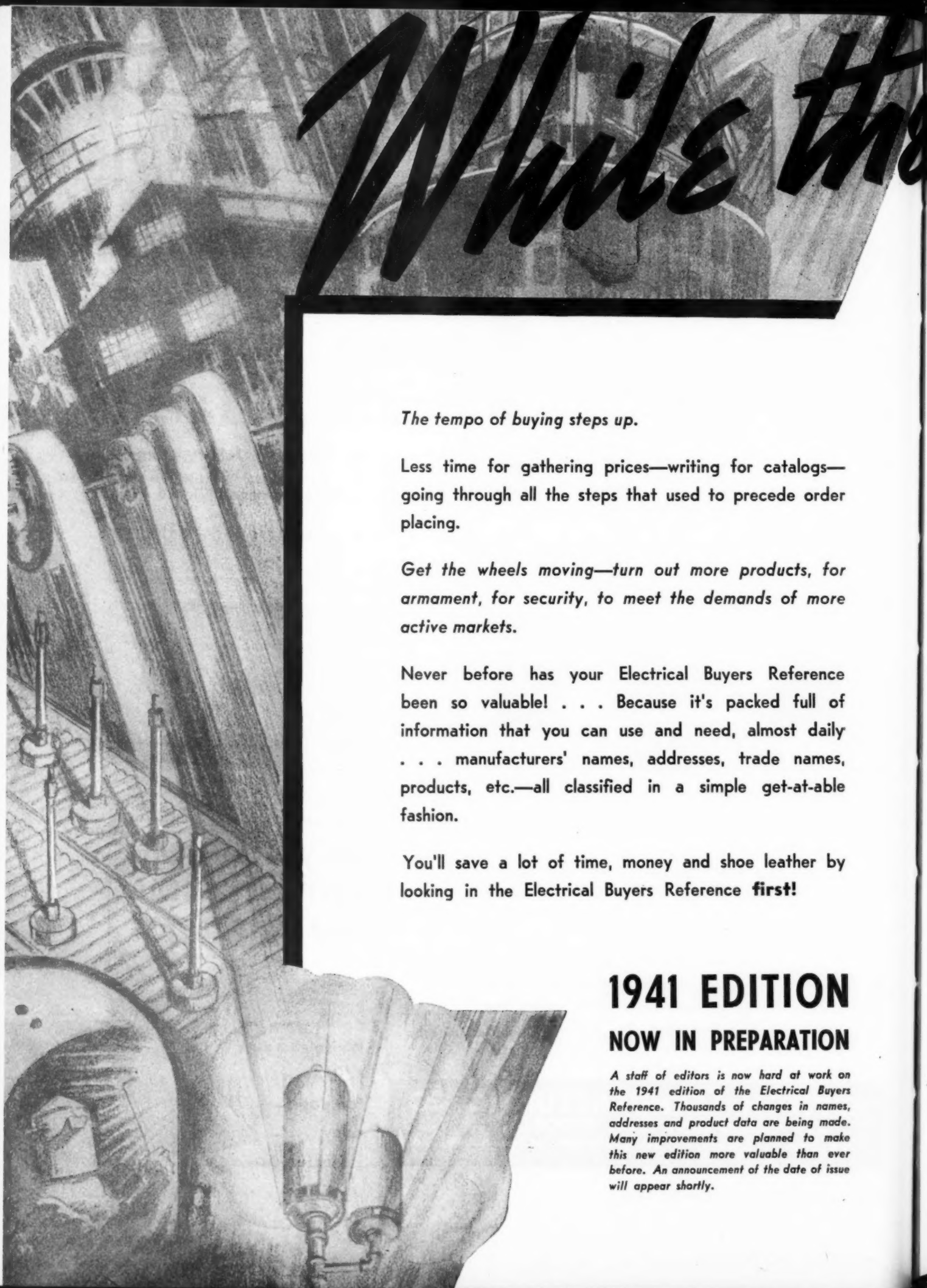

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1941 EDITION

NOW IN PREPARATION

A staff of editors is now hard at work on the 1941 edition of the Electrical Buyers Reference. Thousands of changes in names, addresses and product data are being made. Many improvements are planned to make this new edition more valuable than ever before. An announcement of the date of issue will appear shortly.

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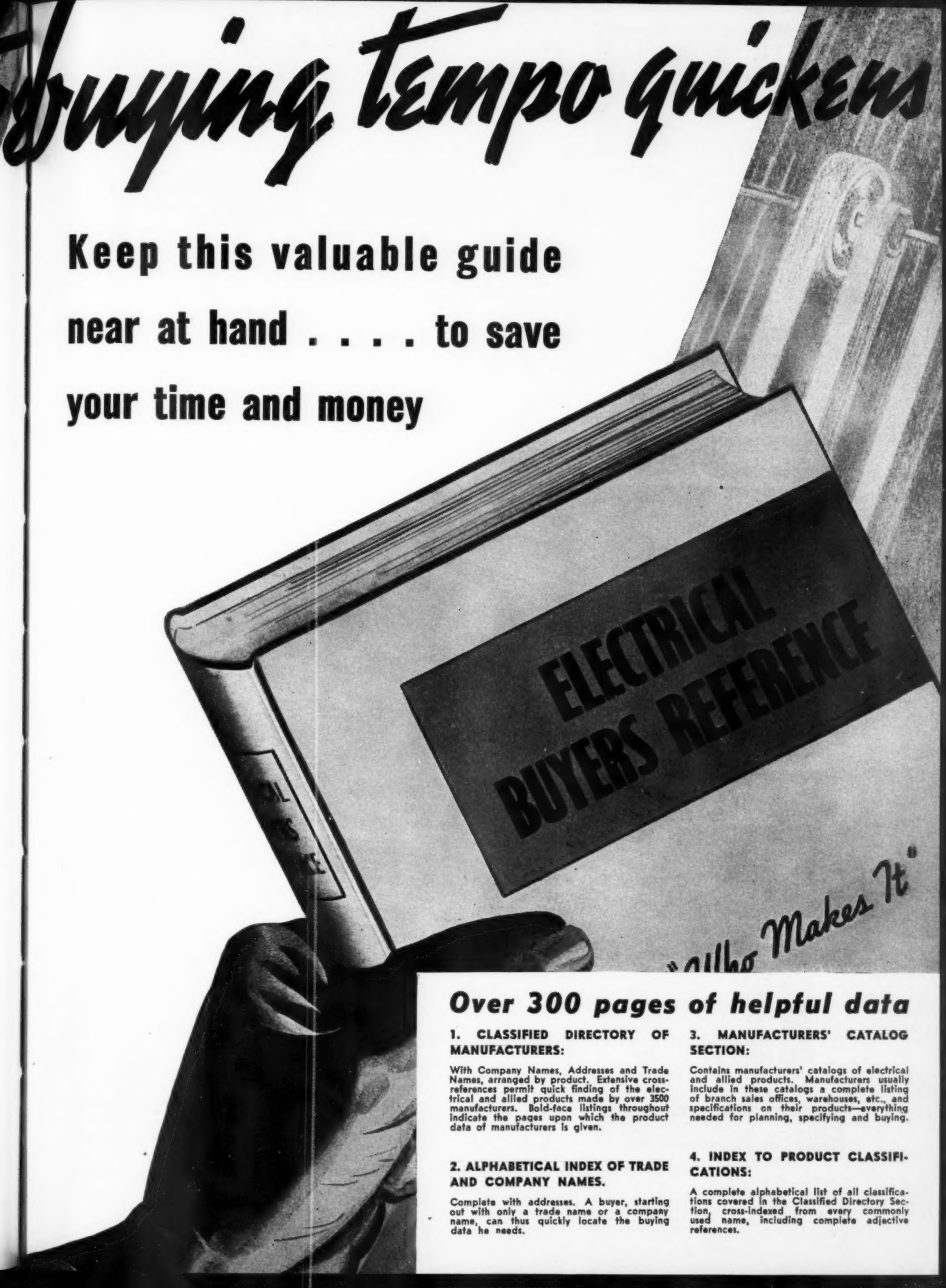

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With Company Names, Addresses and Trade Names, arranged by product. Extensive cross-references permit quick finding of the electrical and allied products made by over 3500 manufacturers. Bold-face listings throughout indicate the pages upon which the product data of manufacturers is given.

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A SIZE and TYPE for every need!

ADJUSTABLE STRAIGHT CONNECTOR

Of minimized dimensions, suitable for use with wires Nos. 14 to 4, solid or stranded. It is only necessary to withdraw the clamping screw sufficient to insert wires, which when tightened, snubs them within the connector. This accounts for the very high strain resistance and maximum of conductivity.

LUG CLOSED

There are no removable parts. End of bolt does not project beyond the line of fitting when closed.

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Motor manufacturers use Chicago Rawhide Mallets for pounding in winding because rawhide never injures insulation.

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Chicago Rawhide Hammers and Mallets with heads of Java Water Buffalo hide treated to last, tightly coiled and compressed into accurate faces (replaceable in the malleable iron hammers), are handy, well balanced tools which mechanics are glad to use. Ask your supply house for a demonstration of any of the 6 sizes of hammers and 7 sizes of mallets.

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Underground Wiring Methods

[FROM PAGE 106]

for the first tier of ducts. Selected backfill should be used between and over the ducts and tamped carefully with a hand tamper. After three inches of this the second tier should be laid and the procedure repeated. Rough fill can then be thrown into the trench.

In the case of asbestos-cement conduit, a water-pipe job is sometimes used when an exceptionally water-tight installation is desired under conditions of unusual hydrostatic pressures. This construction employs a rubber ring in place of compound or caulking material at the joints and gives added flexibility to the conduit run.

A simple wood bench top vise, with hinged openings for two ducts can be built to hold these conduits. The guide stock at the other end holds the ducts steady during the cutting process. Ordinary pipe vises can be used, but care should be taken not to clamp the jaws so tight as to crack the duct or cause it to temporarily spring out of shape. Rubber pads on the vise jaws greatly facilitate gripping the duct.

Cement conduit is of course laid directly in the trench. For multi-duct installations the square type is preferred by the utilities, who seem to be the largest users. It stacks easily, so it is more economical to install. For single or dual duct lines the round type is often used. A waterproof cement must seal the joints of both types.

This duct is heavier and harder to handle than the others mentioned, so length of run, installation conditions and other economics determine its use. The same follows in the choice of tile duct which is used by utilities.

Pump log used most extensively by telephone companies, is also buried directly in the earth.

3. *Trench Burial of Cables*—Underground cables are laid directly in dirt trenches, from 18 inches to two feet in depth to keep them below the normal frost levels and to prevent damage from casual digging. The loose earth at the bottom of the trench and the first few inches of backfill should be free of large stones that may bruise the cables.

To prevent damage from heavy and sharp stones in the rest of the fill, and any future digging that might occur, creosoted plank is frequently laid over the soft cable backfill. There should be several inches of soil between the cables and planks.

Manufacturers can furnish three single cables on one reel where more convenient for installation. This speeds up the laying operation and eliminates cutting the cables. They should be laid a few inches apart and should not cross over each other. Kinks and heavy impacts should be avoided since internal damage to the cable may result.

Excavation methods for this type of cable depend on the length of run, ground conditions and economics. Hand labor, trench diggers or a cable plow may be selected.

This plow, tractor or truck drawn, automatically opens a narrow deep furrow, lays the cable and backfills in one operation. It is especially adaptable to street lighting or underground rural lines where only one cable is used.

Splicing of these cables is an important item since manholes are rarely used. In street lighting, the cable generally runs from one light standard to the other with connections made in its base. Where splices are necessary on long circuits, the instructions of the cable manufacturer should be closely followed. For a splice buried in the earth is not as accessible as one in a manhole.

Rubber insulated parkway cable splices should be protected with water-tight cast iron splice boxes. Those cables without lead sheaths need only the proper rubber and friction tapes.

Manholes

Although manholes are usually an integral part of an underground duct system, they are generally beyond the scope of the electrical contractors field. So their construction is sublet to general contractors. A review of manhole construction is a story in itself and hence is not discussed here.

Selection of System

In general, the choice of the type of underground distribution system depends on the present materials and labor markets, the job and soil conditions, the system voltage, system flexibility, size of job and the necessary degree of cable protection. All in all—it's a question of balancing one method against the other and picking the one that will give the longest life and greatest flexibility and protection at a moderate cost.

With the growing interest in precautionary measures to prevent sabotage on government work, any one of these methods may prove the answer to the customer's problem. However, all should be reviewed and considered before the system is adopted. It offers the contractor a chance to do some good engineering and aggressive selling.

Westinghouse Presents A.. NEW PLASTIC LUMINAIRE

A new Plastic Luminaire,

designed specifically for general commercial installations, is announced by Westinghouse to meet the demand for a low-priced, high quality fixture. This new, luminous indirect unit is ideally suited for the illumination of offices, schools, banks, stores, shops and restaurants, and is available in 300-500 watt size.

Construction Details.

The translucent plastic basin is made to exacting Westinghouse specifications. It provides a pleasing pearl-white tone which blends smoothly with all interior color and decorative schemes. The smooth, polished reflecting surface assures a high reflection factor, and the basin exterior employs an attractive design pattern.

Easily Wired and Adjusted.

The canopy is of heavy gauge drawn brass, supported by a knurled ring on a swivel hickey. Both canopy and ring slip down over the stem for free access when wiring. The one-piece seamless brass stem may be easily shortened to suit variable ceiling heights, while the Westinghouse variable light cut-off is fully adjustable to further meet individual requirements. The heavy drawn brass husk with slightly flared bottom assures maximum rigidity and intercepts a minimum of light. The hanger is finished in satin chromium. Full length lead wires are included.

By all means see this new, low-priced Plastic Luminaire today. Your nearest Westinghouse Lighting Distributor has full details. Or write Westinghouse Electric & Manufacturing Co., Lighting Division, Edgewater Park, Cleveland, O.

PL-500—*New Plastic Luminaire,* designed by Westinghouse engineers for general commercial lighting.

Tune in "Musical Americana," N. B. C. Network, Coast-to-Coast, every Tuesday evening.

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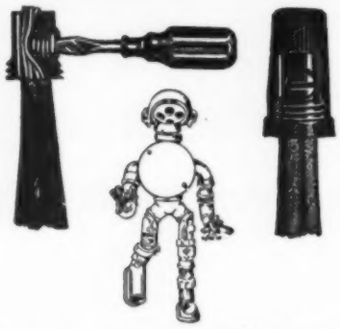

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The MARR
A Perfect Joint Connector
(CAP MADE OF BAKELITE)

The perfect solderless connector with Bakelite Cap. Simply insert wires and tighten screw for permanent joint.

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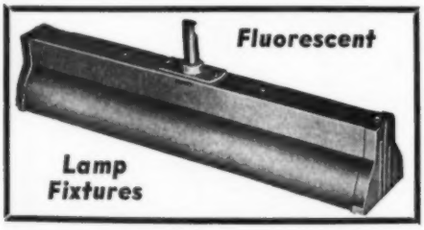

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REFLECTORS
ARE JUST RIGHT FOR YOUR CUSTOMERS' REQUIREMENTS

High lighting efficiency—proper unit for the job from a complete line—economical in cost and upkeep—easy to install—no after worries—that's MULTI Reflectors. For outdoor or indoor installations. More opportunities now than ever before, for these modern lighting reflectors. Get descriptive bulletin today.

MULTI ELECTRICAL MANUFACTURING CO.
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Industrial Reflectors

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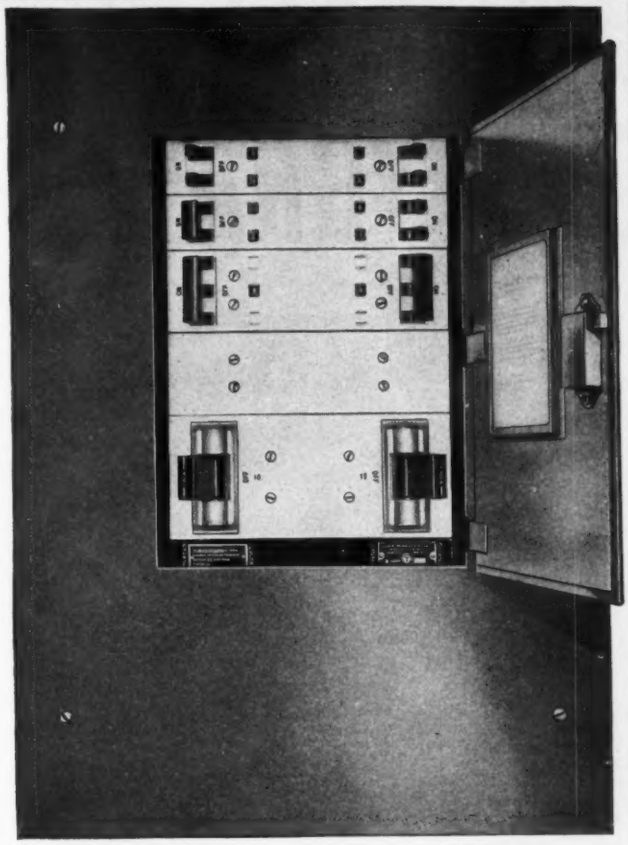

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FULLY AUTOMATIC

OVERLOAD AND SHORT CIRCUIT PROTECTION AT A COST COMPARABLE WITH FUSED EQUIPMENT

Here's a NEW development in application of the time-tested Trumbull Multi-Breaker idea that means LOWER COSTS, GREATER SPEED . . . plus the "last word" in protection against machine "outage"... wherever re-wiring or extension of power circuits is part of Industry's preparedness program.

LOWER COST . . . because these New Multi-Breaker Panels for POWER cost no more than comparable fused equipment.

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Multi-Breaker Units are interchangeable, can be arranged in many combinations.

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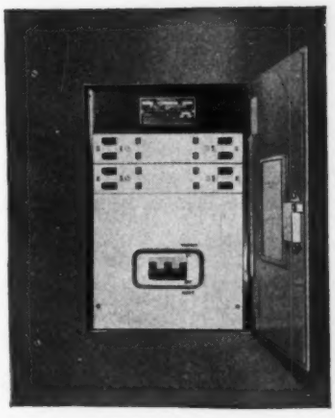
New Two and Three pole Multi-Breaker Units have COMMON trip.



Available in 15-100 amp. capacity, 125 V-230V. AC single phase and 230V. AC three phase.

NEW MULTI-BREAKER LIGHTING PANELS

Now available with three-pole Multi-Breakers in the mains in more compact boxes (5¾" depth) specially suitable for lighting modernization in industrial plants to meet new manufacturing demands.

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Trumbullaids for Contractors

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BIG FALL PROFITS AHEAD ON HYGRADE FLUORESCENT!

FOR COMMERCIAL USE—MIRALUME HF-201:
200-watt unit; 4 40-watt tubes; approximate length, 50".

INDUSTRIAL MIRALUME F-100: *100 watts; 2 40-watt tubes; approximate length, 54".*

These amazing HYGRADE MIRALUMES provide several times the light... light without harsh glare or shadows... light that's 75% COOLER, for equal light-intensity! And MIRALUMES are complete fixtures—supplied wired and ready to install. Also supplied unwired, if desired.

Electrical Contractors report sensationally increasing sales on these nationally-advertised "packages" of COOL DAYLIGHT— MIRALUMES!

YOU will be amazed how Hygrade Fluorescent Light *sells itself*—in factories and stores, offices and schools, hotels and restaurants, theatres, barber shops, laundries—*everywhere!*

With MIRALUMES you can obtain high levels of cool, comfortable illumination — decreasing eye-strain, accidents and fatigue!

Find out *today* about low MIRALUME prices to you, and FHA financing plan!

SHOWN HERE are two of many MIRALUMES ready now. Designed, engineered, built and *guaranteed* by HYGRADE! Corrected for power factor and stroboscopic effect. Starters easily accessible.

Hygrade Fluorescent Lamps are easier to sell because you can *demonstrate* their superiorities ...superior coating, finer-grained coating, standardized colors, superior performance!

LOW COST Hygrade FULL LIFE MORE LIGHT

NOTE: Extraordinary lighting efficiencies are obtained in fluorescent lamps by tuning the electric discharge to concentrate its ultra-violet energy at the precise 2537 Angstrom Unit wavelength most effective in causing the porous film (Hygrade Patent 2,096,693) to generate light. This achievement, so important to the efficiency of HYGRADE MIRALUMES is described in Patent No. 2,126,787, now controlled in this field by HYGRADE.

WRITE TODAY for complete information, prices, discounts on MIRALUMES and HYGRADE FLUORESCENT LAMPS: Dep't EC9, Hygrade Sylvania Corp., Ipswich, Mass.—or your Electrical Wholesaler.

Fluorescent at its Finest—

Fluorescent Lamps **Hygrade** Miralumes

HYGRADE SYLVANIA CORP., EST. 1901. ALSO MAKERS OF THE WORLD-FAMOUS SYLVANIA RADIO TUBES

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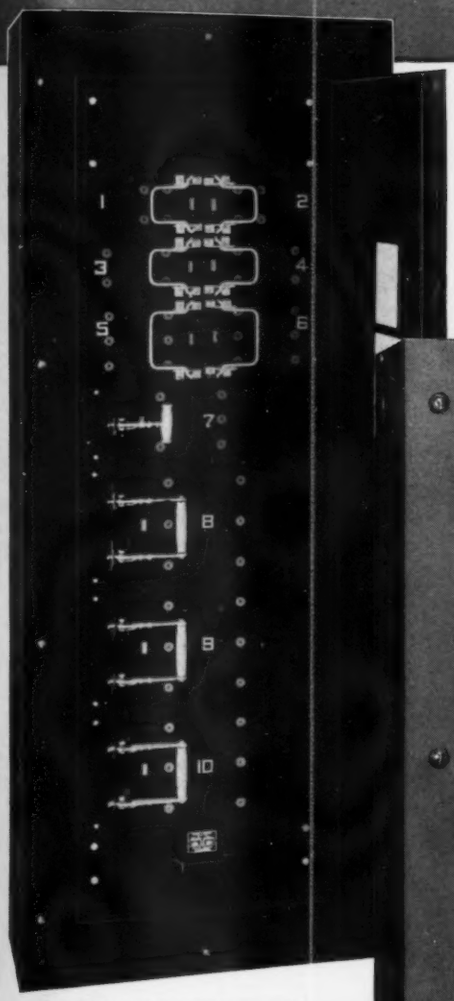
Seeking new fields to serve...

SQUARE D *Announces*

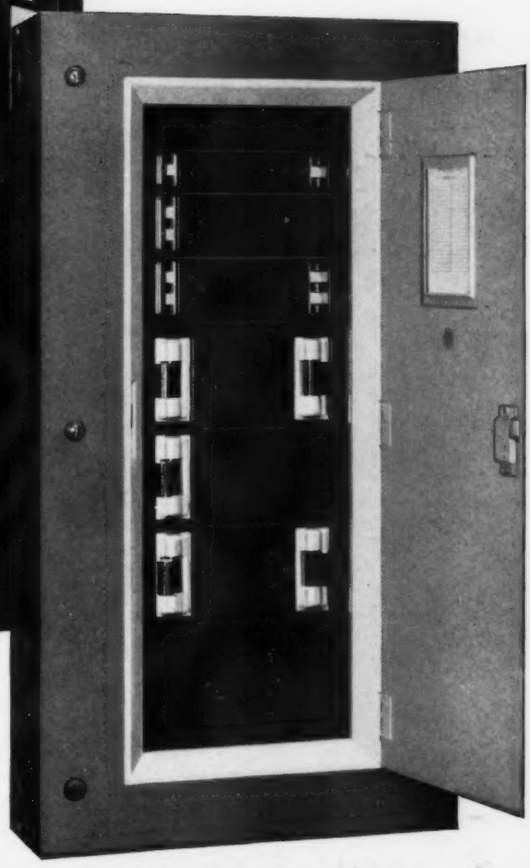
THE *MH*

MULTI-BREAKER DISTRIBUTION PANELBOARD



FUSIBLE PANELBOARD

Illustrated above is a standard fusible distribution panel for power and light.



NEW *MH* PANELBOARD

Compare the size of the *MH* panel with that of the fusible panel at left. They both do the same job!

The famous Multi-breakeR principle of simplicity in circuit breaker construction has now been extended to include 100 ampere, 230 volt, branch circuit capacity for power and lighting distribution. Thus for the first time, circuit breaker protection for power and light distribution can be provided at a cost little more than that of fused circuit protection.

Breakers are furnished in 15 to 100 ampere capacities—1, 2 or 3 poles, for 115 and 230 volt, single phase and 3 phase, A.C. systems. Since all breakers used in these panels are common trip (that is, an overload on any pole will cause all poles to trip), they are suitable for use on ungrounded systems, and single phasing of motors protected by these circuits is prevented.

The panels are completely dead front—no live parts are exposed even when restoring the service after an overload or short circuit. The simple rugged construction of the breaker units assures the same long life and trouble-free service that has made the other Multi-breakeRs so outstanding.

***MH* panels are unusually compact—see illustration at left. Therefore, on rewiring jobs, the use of *MH* panelboard interiors in existing panel boxes will provide the additional circuits made possible by the use of the new thin wall wire.**

For complete information, write for Bulletin 5200 and see how inexpensive the new *MH* panel makes modern circuit breaker protection.

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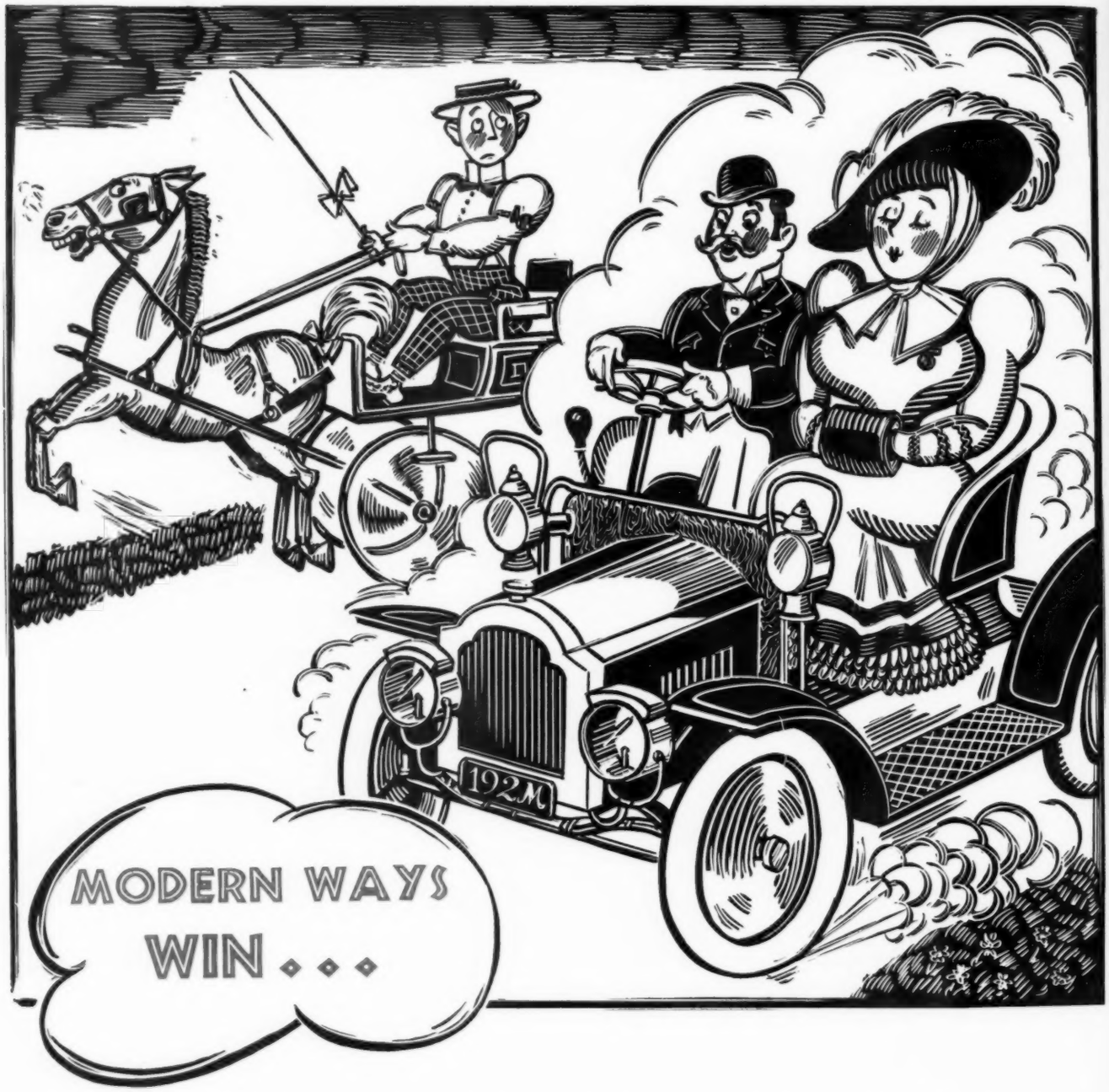

JUST as Tom lost Mary 35 years ago because he drove a horse and buggy, so some electrical contractors today are losing business because of skimpy "horse and buggy wiring methods." Every time a contractor installs skimpy, old-fashioned wiring he loses the opportunity for a bigger job. All buildings need modern wiring so that electricity can be used conveniently and efficiently. Modern ways benefit both your customers and yourself.

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Use G-E wiring materials to help in selling and installing adequate wiring. Your customers know that the G-E monogram stands for quality and dependability. The G-E line of conduit, wires and cables and wiring devices is complete. There are materials of the proper kind and size for any type of adequate wiring job in factories, homes, schools, etc.

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If you are interested in wiring homes it will be to your advantage to follow G-E Home Wiring methods. G-E Home Wiring will interest your customers and will provide adequate wiring jobs. Every customer will be your booster.

For further information about G-E wiring materials or G-E Home Wiring, see the nearest G-E Merchandise Distributor or write to Section CDW-0129, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

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